The Builder.

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Fergusson's History of Ancient and Mediæval Architecture.

WHILE Fergusson's great encylopædic work on the history of architecture remains, in all its essentials, a possession for ever for English students of architecture — for all students of architecture, in fact, "*sua si bona nôrint*"—it was inevitable that as time went on, and further discoveries in archæology were made, some revision should be called for in successive editions of the work. On the whole, we may feel surprised, in this generation of archæological research, that the necessary amount of revision should be so comparatively small, rather than that some degree of revision should be necessary. In bringing out a third edition of the book, with such notes and alterations as are requisite to bring it up to date,* the publisher could not have made a better choice of a revising editor than by putting the work into the hands of Mr. Spiers. In regard to the ancient architecture of the pre-Christian era, about which there is most room for speculation and for difference of opinion, and which has been the principal field of recent archæological research, Mr. Spiers is one of the best-informed men of the day; and while he has brought his knowledge to bear in correcting such of the views of the original author as must now be regarded as doubtful or untenable, he has done this in the most unobtrusive manner possible, mainly by adding foot-notes here and there representing the modified views of the present moment, and the reasons for them, without interfering with the author's original text where this could be avoided.

The most important points in which revision was considered necessary are mentioned in the editor's preface. In Egyptian architecture the accurate measurements of the Pyramids made by Mr. Flinders Petrie, and his correction of Lepsius's theories as regards the Labyrinth, have placed information at his disposal which was unknown to Mr. Fergusson. The results of recent discoveries in Greece and Italy have been recorded, sometimes in the text, sometimes in footnotes, and changes have been made in the chapters on Parthian and Sassanian architecture, based on M. Dieulafoy's photographs, which have enabled the editor to correct some of the illustrations copied from Flandin and Coste's work. In the second volume, dealing with Christian architecture, the Byzantine style has been rightly placed first; we always considered it a curious freak of arrangement on the part of a writer mostly so methodical as Fergusson, and who looked at architecture so much from the historical point of view, to have placed the Byzantine style at the end of his Christian volume, giving the reader the sense of going far back again in architectural time after he had been taken through the rise, development, and decline of Gothic architecture. The description of the Mosque of Omar has been transferred to the portion of the work on the Saracenic style. As the editor observes, Fergusson had few supporters in his views as to the origin of this building, which he maintained with characteristic obstinacy in the face of evidence and argument which he should have felt to be conclusive against them. It was part both of the strength and the weakness of Fergusson that he never would give up a conclusion once formed in his own mind. In some cases his persistency was rewarded by unexpected confirmation of his views; in other cases he put himself in the unfortunate position of maintaining, from mere unwillingness to own himself in the wrong, opinions which almost everyone but himself perceived to be untenable. But making all allowance for this, it is wonderful how right he has been, on the whole, in so great a task as giving a summary of the whole history of architecture. Fergusson's description of the probable mode of lighting Greek temples, upon which he especially prided himself, and which was for some time accepted by many Greek archæologists as the most probable or possible mode of lighting that had been devised, the editor leaves as it was in the text, only adding a footnote giving Dr. Dörpfeld's conclusions on the subject after Mr. Penrose's explanation of the Olympeion and we also observe that the section of the Parthenon given on the title-page no longer bears the inscription "Section of Parthenon showing the mode in which light was admitted," but is amended to "Showing the author's views as to the admission of light." This was the best way to treat it, for though we cannot now accept Fergusson's view as ascertained or even as probable fact, it was so ingenious, and obtained for a time so much support, that he certainly had a claim to have it permanently connected with his name, as one example of the resources of fancy and suggestion which he brought to bear on architectural history, and which in some cases at least led him in the right direction.

Among the modifications or improvements which have been made in the chapter on Egyptian architecture, the plan of the Hypostyle Hall at Karnac is shaded so as to show the portions actually standing, instead of giving it, as in the earlier editions, as if it were all in existence; and two of the plans of houses discovered by Mr. Petrie at Kahun (one of which, by Mr. Petrie's kindness, was first published in our columns) are added to the plans of Egyptian structures; also the very interesting and unusual plan of the temple at Abydos. The paragraph about the Mammeisi temples and their being the origin of the Greek peristylar temple is left as it originally stood. A note of interrogation might have been put to this, seeing that only one temple of this class of the præ-Greek period has ever been known in Egypt, and that is now destroyed and was never perfect within the memory or record of archæologists, and its correct restoration is matter of dispute; and we should very much doubt whether the Greeks would have been specially influenced by such a small and unimportant phase of Egyptian architecture, when they had such far grander and more important structures before them. But the fact is that Fergusson had taken the Egyptians, as he did the Hindus, under his special architectural favour and protection, and wished to make out that the Greeks owed everything or nearly everything to them; hence this emphasis on the Mammeisi temple, which seemed to give a "lead" for the Greek peripteral temple. There are other ways of deducing the Greek peripteral temple, none of them indeed resting on ascertainable fact, but certainly more probable than this.

Under the new arrangement of the history,

* A History of Architecture in all Countries, from the earliest times to the present day. By Jas. Fergusson, D.C.L., F.R.S., M.R.A.S., F.R.I.B.A., &c. Vols. I. and II. Third Edition. Edited by R. Phené Spiers, F.S.A., F.R.I.B.A. London: John Murray; 1893.

Lombard architecture follows Byzantine, and connects it with Byzantine Romanesque; and French architecture is all relegated to the Gothic portion of the second volume, which is its proper place. In the former edition French architecture followed, not very logically, on the first chapter of the Christian architecture devoted to Romanesque work. In the new edition Byzantine architecture commences the department of Christian architecture, as it certainly should, since it was unquestionably the first new style which arose since the Christian era, the early basilica churches of Italy being only a modification of the materials (both in the æsthetic and in some degree in the physical sense) of Roman architecture. Byzantine is followed logically, in the new book, by "Byzantine Lombard" and "Byzantine Romanesque," which closes the first volume, the Christian architecture of Italy being continued into the second volume; and then we have France, very fully treated, followed by Belgium and Holland, Germany, Scandinavia (which seems to be dragged in here a little out of its due claims), and then English Gothic. We should have preferred to see French and English Gothic placed together and forming the important central portion of the second volume; England certainly has closer connexion architecturally with France than with any other country, and the two together represent Gothic architecture in a sense in which no other two combined countries represent it. The Gothic of Spain and Portugal follows England, and the volume concludes with Part III. oddly entitled "Saracenic and American Architecture"; there are separate chapters or "Books" for each, of course, but this collocation of them in the main title might beguile the ignorant or careless reader into the idea that the author intended to imply some kind of relationship between the two, which he certainly could not have intended; they are merely put together at the end because they are both rather peculiar and out-of-the-way chapters in architectural history, which could not well be connected with any other portion of the book. Saracenic architecture, of course, is peculiar in a historical sense as being, in its finest developments, of no special country, but belonging in turn to the various countries in which Mahommedan rule by turns dominated; like the artillery corps, it went *quocunque fas et gloria ducunt*, and thus had to have its own sub-section of geographical divisions, apart from the general history of architecture in special countries. Its separation was thus necessary; but why couple it with ancient America?

However, this is only a slight remaining deficiency of method in a book in which the method has been much improved as a whole by the present editor, as well as some of the details, without in any way detracting from the merits of the original author or altering the main design and physiognomy of the book. It is still "Fergusson's History" in all its main features, only corrected and brought up to date where necessary by the editor, with a care and industry on the one hand, and an absence on the other hand of all effort to thrust himself in front of the original author, which cannot be too highly commended. We have thus a considerably improved but still perfectly recognisable issue of what is certainly, as far as we know, the most remarkable attempt at a combined and continuous history of the whole of architecture which has ever been produced, and which is a lasting honour to English architectural literature.

RE-OPENING OF GRAY'S INN CHAPEL.—Gray's Inn Chapel was re-opened on the 28th ult. by the Bishop of Marlborough, after having been closed for several months during restoration. The alterations, carried out by the instructions of the Benchers and Master Rose, at a cost of 2,500*l.*, consist of a panelled oak roof, open oak seats with carved ends on the floor, and a carved oak screen. During the alterations, which were carried out under the direction of Mr. Shoppee, the architect, two three-light Tudor windows were found embedded in the south wall; these are now left exposed.

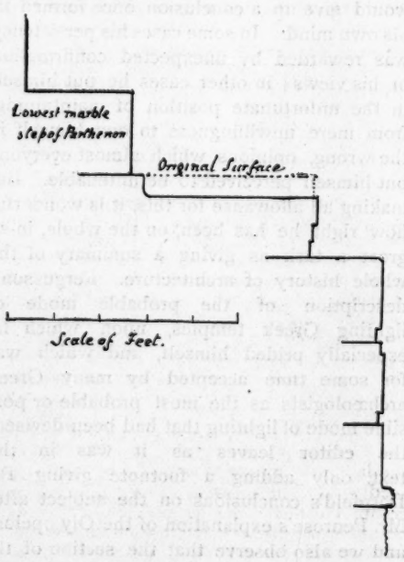
THE EARLIER PARTHENON.

By MR. F. C. PENROSE.

I HAVE read with great interest your leading article of the 13th ult. on Dr. Furtwängler's "Meisterwerke der Griechischen Plastik," and have also, to some extent, looked into the thick and important volume itself: full of suggestive matter. The author of so many new theories, however ably propounded, cannot, I think, expect them all to be accepted without opposition—and I find there is an architectural question to which I feel called upon to raise objection; and that is the theory of the earlier Parthenon. This question, treated as we find it in the volume and most lucidly brought out in your leading article referred to, remains, I think, unsolved by the views we find in that volume, whether after Furtwängler we ascribe its foundation to Themistocles, or, after Dr. Dörpfeld, to Cimon; though I certainly think that, of these two claims, Themistocles has the best of it; but that both are involved in greater difficulties than the older view that this work was pre-Persic,

I have argued the point more at large than I can do here in the "Journal of Hellenic Studies, 1891," which article was answered by Dr. Dörpfeld in the *Mittheilungen*, No. XVII., 1892, to which I replied in the "Hellenic Journal" for last year. I will endeavour to state the more salient facts. To begin with the Archaic temple, the foundations of which abut on the Erechthion site. Of this temple very clear evidence is to be got of its length and breadth. One stone also of its northern stylobate is preserved, having a width of 5·210 ft., and in another part of the Acropolis there are several stones of similar character, which certainly came from the same temple, from which a slightly increased width is obtained—(5·320)—which might have come from the east or west fronts, but more likely from the southern flank. This stylobate and the greater part of the foundation on which it stood, of which much remains, is formed of a stone obtained from a quarry at some distance from Athens — being a better description of stone than the blocks of the Acropolis rock which formed the foundations of the cella wall—but in other respects I could not discover any decided difference of workmanship between them, nor do I see that there is any sufficient reason for assigning a difference of date between the peristyle and the cella. No doubt there are portions of the interior much older than either.

To return to the Parthenon substructions. On the south side, as is well known, there is a massive wall founded on the rock about 250 ft. long and 30 ft. high, the top of which has a section thus:—



which was altered by the Pericleian builders at the western return, but at the east end retained the original profile. The western extremity of the wall coincides practically with the projection of the Parthenon steps, but at the eastern end is carried about 14 ft. beyond them. Near the north-west corner of the Parthenon the extremity of the western return, running northwards, of the old substructure can be seen. It is on this substructure that the design for an unfinished earlier Parthenon, whether, according to Dr. Dörpfeld, by Cimon, or Dr. Furtwängler, by Themistocles, has to be placed. The columns of that design being, as will be shown, very much crowded in consequence, and having, on the south and east, at any rate, a lower step of very narrow proportion, and with a 6-ft. drop immediately below it on the south side.

There is, however, another explanation of this substructure and of the narrow step spoken of, namely, that the temple itself retired a little from the edge of the great wall, and had around it a terrace of some width, which crowned the substructure walls. In that case, the step found near the edge was the continuation of the step by which this platform was approached from the east, and, perhaps, the west and north also; and, moreover, that the temple itself had already superseded the Archaic temple before the Persian invasion. I must refer the reader, for the ground upon which this restoration of the temple has been founded, to the articles already cited in the "Hellenic Journal," or the "Athenian Architecture" (Second Edition), chap. xiv.; and it is to this temple that we ought to assign the remains of Doric entablature, and most of the fragments of large columns formed of limestone, which remain built into the walls of the Acropolis.

On the other hand, Dr. Dörpfeld's theory, which, in the architectural aspect, is unquestioned by Dr. Furtwängler, is that the remains just referred to were the entablatures of the Archaic temple; but to make them fit the existing stylobates he is obliged to do great violence to architectural analogy and proportion.

The recent thorough examination of the old walls and heaps of ancient material on the Acropolis has produced many valuable records, and amongst them some Doric capitals of large size and formed of limestone, one of them giving the measure of the diameter of the column at the necking as 4·282 ft. This, from the analogy of a series of early examples, should require a base diameter of 5·754 ft. The same researches have brought to light a drum of a fluted Doric column of character exactly suited to the capital referred to, which measures 5·811 ft., which diameter is therefore quite suitable to the cap. I propose to show that such a column is entirely out of keeping with the stylobates of the Archaic temple. We have seen that there are measurements certain of the northern, and highly probable of the southern, stylobate. The mean of the two will be 5·265 ft.

There are several instances of intercolumniations on the fronts of a temple being wider that those of the flank, and that was, we know, the case with the temple to which the entablatures which have been mentioned belonged; for they show by their detail that those on the front were the widest. At Corinth, where this variation also occurs, the columns on the front are also decidedly larger in diameter than those on the flank.* At the temple of Jupiter at Olympia there seems no appreciable difference in the intercolumniations, but the columns are very slightly thicker, viz., in the proportion of 1·0181 to 1. At Ægina, which, from its date, should give a useful comparison, there seems to be no difference either in the intercolumniations or the columns. These ratios rank as below.

The Heræum, at Olympia, may be mentioned as an instance where the intercolumniations of the front exceed those on the flank, but the variations *inter se* of the

* Comp. Vitr. III.,

diameters of the columns hinder any other satisfactory comparisons being made.

	The Acropolis Entablatures in question	Corinth.	Jupiter at Olympia.
Ratio of front and flank *columniations, i.e.*, centre to centre	1·0563 to 1	1·0820 to 1	1·0019 to 1
Ratio of diameters front and flank ...	—	1·0562	1·0181
Ratio of width of stylobate to column base	—	flank 1·1163 front 1·1411	1·0950 1·0758

It will be fair, not to say very favourable, to the theory which attempts to adapt these remains on to the Archaic site, to use the example of Corinth in calculating the requisite proportions.

Taking the width of the stylobate on the flanks at 5·265—

The proportion $\frac{5\cdot265}{1\cdot1163} = 4\cdot7164 =$ { The diameter of column suited to the flank stylobate.

Then $4\cdot7164 \times 1\cdot0562 = 4\cdot9815$ { The diameter of column suited to the front stylobate.

The above is the diameter of the front column as derived from the measures of the Archaic temple, viz., 4·981 ft.

Now take the old remains in the Acropolis wall.

The cap we have seen gives the upper diameter of the column = 4·282.

The mean of nine old Doric examples gives the ratio of 1·3437 for that of the lower diameter to the upper, in which list the example at Corinth enters as 1·340.

Using this latter quantity, $4\cdot282 \times 1\cdot340 =$ 5738.

This difference between 5·738 and 4·981, more than 9 in., cannot be conciliated without unjustifiable violence to architectural propriety. Had the calculation been made on the analogy of the Temple at Olympia, the discrepancy would be more than 10 in.

The requirements of the Archaic temple seem to be perfectly satisfied by the discovery of a fragment of a large Ionic capital of limestone, which would fit the known stylobates of that temple. It follows that we are fully justified in seeking another site for the Doric remains, and the site of the pre-Persic Hecatompedon, which has already been spoken of, is obviously the proper place for them. This view is very greatly assisted by some remains of incised marks on that very substruction wall; the measurements of the intervals between these marks have a remarkable relationship with the dimensions of the entablatures referred to. The subject of these marks, and the restoration of the temple which is derived from them, has been discussed at length in the articles in the "Hellenic Journal," already referred to, and also in "The Principles of Athenian Architecture," and to repeat it *in extenso* here would require more space than I am justified in asking for. Whatever theory is advanced on the subject of the earlier Parthenon, those marks must be taken into consideration as facts of importance which demand explanation.

Again, when we come to examine the proposed post-Persic predecessor of the Parthenon, there are serious architectural difficulties to be got over. The profile of the three-facia course which is assumed to be the riser of the lower step on which this temple stood (and, indeed, it is not even a continuous homogeneous step, for near the N.-E. angle of the Parthenon it merges into the rock), has a section differing very much from the ordinary form given to the steps of temples. It is also unusually narrow in comparison with its height, and is composed of blocks which, whilst they have a considerable depth inwards, have very short dimensions (averaging less than 3 ft.) in the running direction of the step. Such lower step would be expected to show its length the other way. This way of laying the blocks is not easy to explain on the post-Persic temple theory, but would exactly suit the capping of the podium on the other hypothesis.

Again, when a second step has been put above it (and if a temple step at all, it is admitted that it must have been surmounted by another) the intercolumniation becomes unusually close, especially in the fronts, where, too, it would be rather less than on the flanks, which is most unlikely to have been thought of. Dr. Dörpfeld, in his arrangement of the plan, has indeed attempted to expand the three middle front intercolumniations by contracting the spaces next the angles beyond all precedent, but there could have been no necessity for such crowding, for a little extra space to the north could readily have been taken.

I fully allow that Dr. Furtwängler has put his case for the Themistocleian foundation of this temple very plausibly, and we are invited to admire the great Athenian's bold innovation in removing the centre of worship to the southern part of the hill; but against this new argument another new line of defence may be erected on the other side. The theory of the orientation lines of Greek and Egyptian temples, giving a key to the dates of their foundation, is certainly sufficiently advanced to be called upon for evidence on such a point as this, and it follows from this theory that this site had been occupied by a temple for centuries before the Persian invasion, and I feel convinced that the old pre-Persic Hecatompedon —the rightful owner of the old Doric Porosstone remains, a temple of sufficient importance and magnificence to have superseded the Archaic Ionic temple, and which as the one pre-eminent temple of the goddess witnessed the last and unavailing retreat of the fugitives—was not, indeed, that original, but a successor on the same parallels—all modern theories notwithstanding.

In page 743 of Furtwängler's work there is a passage which has a direct bearing on this question which may be translated thus :—

"Penrose, in 'J. H. S.,' xiii., 32, has attempted once more to defend his view against Dörpfeld. But he has produced nothing that can shake Dörpfeld's result. The decisive point is the explanation of the *Auschütung* (filling-in) on the south side of the Parthenon. Here everyone who was able to examine the filling-in during the excavation will range himself decidedly on Dörpfeld's side. The streaks of building chips are impossible to doubt. If the filling-in is contemporaneous with the building, the question is settled against Penrose."

This argument, derived from the appearance presented by the filling-in, seems to be relied on as the strongest attack which can be made against the theory of a pre-Persic Hecatompedon, and it must be admitted that if the premisses were incontrovertible, it would be difficult to oppose the conclusion; and no doubt at first sight the argument seems much in favour of the contemporaneous working of the great foundation wall and the filling-in which was laid against it; and it may easily have been that this explanation was accepted by the majority of those who were on the spot at the time of the excavations; but this first-sight appearance, when looked at carefully, seems to me to fail very materially. The contention is that the wall was built without scaffolding, and that as it gradually rose, a certain depth along the side of the wall, equal to the height of one or two courses, was filled in with material which was then thought to be rubbish; and when this was raised to the desired height, additional blocks of the Peiraic stone required for the wall were brought there in the rough, and were worked upon the newly-made ground, and that it is from the chips from these workings that the horizontal streaks of a peculiar kind arose, which show distinctly in the photographs taken during the operations, and which were recognised as building-waste at the time. As these streaks, which divide the more confused layers from one another, run uninterruptedly in lines of very regular thickness right up to the wall, it is also necessary to conclude that the wall, if built contemporaneously, was built with no better scaffolding than could be afforded by this newly-made ground; for if there had also been timber supports against the wall, the regularity of the layers must have been disturbed. It is their extreme regularity as exhibited in the photographs which defeats the argument. This is fortunately a practical question of which most of the readers of the *Builder* are better fitted to judge than the most learned interpreters of vases and inscriptions.

In my second article in the "Hellenic Journal" for 1892-93, p. 33, I wrote thus :—

"I am entirely at issue with Dr. Dörpfeld in saying that 'the wall was built without scaffolding, but that earth and broken stone fragments were deposited to a depth equal to one or two courses at a time as might be required for building up the wall without scaffolding.' Loose material, such as this, unless consolidated by abundance of water—an element not likely to have been available on the Acropolis—and allowed to dry, would indeed have formed a very poor substitute for scaffolding for heavy work. The photograph—whether that given in page 290 of the 'Hellenic Journal,' or in Pl. IX. of the *Mittheilungen*—does not show much conformity in the thickness of these strata in connexion with the courses of the masonry, but it does show the remarkable eveness of level of the strata themselves. Any architect or engineer who has seen works carried on under at all similar circumstances must have noticed how the ground has been cut up and furrowed by the traction and pitching down of heavy material. I do not express only my own opinion on this point. The thin lines of poros stone chips shown in the photograph and referred to in page 162 of the *Mittheilungen* are quite inconsistent with the explanation there given. Had they arisen from dressing the blocks of the wall, they would have been pounded and mixed in with the general mass of the terrace. These chips, when Ross and Ziller saw them on the sides of small excavations, may easily have been interpreted by them in the sense quoted; but they offer quite a different appearance when seen in their whole bearing, as in the photograph of the complete excavation—namely, this, that as each layer of earth and other rubbish, as it was then thought, was thrown in 3, 4, or 5 ft. thick as it might be, the top of each surface was metalled, as it is called in road-making, with these stone chips, of which there must have been an abundance on the Acropolis, from the repairs which were in progress, so that the layers might be the more effectually rammed and consolidated. For it was obviously of great importance that this earthwork should afterwards subside as little as possible.

Thirty feet or more of loose earth and broken rubbish would have furnished a very insecure foundation for the timbering required soon after its formation for the great architrave stones of a temple built immediately on the top of the wall."

I may add that it seems probable that the stones used in the building of this and similar walls which are almost all of equable scantling would have been shaped at the Peiraic quarries (the Pentelican drums certainly were scapled into shape), and would only require to be jointed at the "job." Such work would not make enough chips to have formed these streaks. There would be many other operations going on at the time where stone cutting of a more complicated kind was being executed, involving much waste from which the chips wanted for these layers would have been collected.

Connected with this filling-in deposit an explanation is wanted of the presence of a number of Pentelic drums which were found embedded in it. I have explained them as materials prepared by the Peisistratidæ for a marble rebuild. But if either Themistocles or Cimon built the wall, intending to proceed to build a marble temple above it, how came they there?

Although I have felt that on this one point there was room to differ from Dr. Furtwängler's view, I must not omit in conclusion to express my great admiration for all else that I have seen of the book and of the article in which you have so ably published a *résumé* of the principal architectural and sculptural points in connexion with the Parthenon.

F. C. P.

THE FAWCETT FIREPROOF FLOOR.—We are informed that the patent for this form of floor has been purchased for the United States for 50,000*l.*, and that it has been used in the Bank of North America, in the State Capitol and Library, and Harrisburg, and elsewhere.

NORWICH MAIN DRAINAGE.—The contract amount for this work should have been 1,776*l.* 8s. 11d., not "1,176*l.*" as printed in our last.

NOTES.

ON Monday the House of Lords had to consider whether they should agree to the action of the House of Commons in rejecting the contracting-out clause inserted in the Employers' Liability Bill when it was in committee of the House of Lords. They decided to adhere to their clause, and the Bill must go back to the House of Commons. The Government must now choose between passing the Bill with the clause or giving it up altogether. According to all the signs of the times the Government will drop their Bill rather than accept this just and reasonable clause on contracting out. By so doing they will show that they have not the true interests of the workmen at heart, but desire only to seek a party advantage. The House of Lords would let those workmen who wish it make arrangements with their employers, by which the workmen shall run no risk of losing compensation for injuries received in the course of their duty. The Government would force them to go to law, would expose them to the risk of getting no compensation unless negligence was clearly established on the part of the employer or of a fellow workman, and would deprive them of the compensation which can be received under these mutual insurance schemes when the workman himself has been negligent. Moreover, the contracting-out clause is surrounded by all sorts of safeguards to prevent the workman from being pressed into an arrangement against his will, or from being deceived by a bogus fund. If the Employers' Liability Bill does not become law this month, it will be wholly and solely the fault of the Government.

THE French Government are being urged to adopt various recommendations tending to render France less dependent upon neighbouring nations for coal, &c. The measures proposed include an extension of the canal system, also a general lowering of rates for French coal by railway, and making it obligatory for railway companies to use only native coal, save in case of exigency. At a debate which took place last week in the Chamber of Deputies, the Minister of Public Works significantly remarked that the output of coal in France must necessarily remain insufficient "until the coal industry inspired more confidence among capitalists." The decreasing returns from many a British industry might well serve to check that inclination to make war upon the capitalists, which is, unfortunately, getting so common. The lack of confidence, which is the outcome of ever-recurring disputes, goes far towards weakening the commercial prosperity of any country, to the injury of capitalist and workman alike. As to the carriage of coal in France, the Chamber declined to adopt an order calling upon the Government to compel reductions, but will endeavour to obtain better terms from the companies by other means. The petitioners were more moderate in their demands in this respect than the ironmasters of Sweden, who recently petitioned the King to reduce freights in that country. They claimed that the carriage of many articles, such as iron goods, both raw and manufactured, fire bricks and clay, &c., should be reduced by from 33 to 50 per cent., while at home we have to fight against advances in rates which were already higher than those in force on the Continent.

IT is urged, we believe, by the supporters of that curious mania called the "eight hours' movement," that no loss of production would ensue from forcibly shortening the hours of labour, because the lighthearted artisan, stirred up to unwonted energy by the contemplation of his shortened hours of work, would put as much real effort into his limited eight hours as is now distributed through the longer hours of his present task. As bearing on this subject we have received an interesting letter from a correspondent in Southport, connected with the building trade, who informs us that his neighbourhood presents an object-lesson in the practical effects of the eight hours' day. For twenty years, according to our correspondent's statement, a forty-eight hours' week has been the rule in his town for building and allied trades. But none of the beneficial results promised from the eight hours' movement have followed in this favoured spot. "There is not more diligence in any given number of hours than formerly. There is not the same output of labour, man for man, per week, as under the old dispensation; one result of this being that tradesmen are driven to a more and more extended use of machinery and labour-saving appliances, in order that they may be less dependent and less under the dominion of the skilled artisans of the day." Such is the testimony of our correspondent, extracted from a long and interesting letter. We should be glad to hear if any employers of labour in the district referred to have any supporting or conflicting testimony to offer on the subject.

AN interesting decision was given last week on the Housing of the Working Classes Act, 1890. When a Medical Officer of Health reports that an area is unfit for human habitation, the Local Authority may propose a scheme for the demolition of the existing houses, the owners of which are to be compensated, the amount to be settled by arbitration. Against the certificate of the arbitrator there is an appeal to a jury, provided that leave is given to appeal by the High Court if it is satisfied that there has been "a failure of justice." In the present case the claimants were not satisfied with the arbitrator's award, but the Court would not allow the appeal, holding that a substantial difference between the amount claimed and the amount awarded did not necessarily show a failure of justice. The decision is right; if it had been to a contrary effect every dissatisfied claimant would appeal. The Court, with much caution, declined to lay down any definition of the words "a failure of justice," contenting themselves with saying that they saw no failure of justice in the present case. This was a proper and practical way to deal with the matter.

AN appeal has reached us from the Greek Syllogos of Candia with respect to the famous Gortyna inscription. This inscription, it will be remembered, was discovered in 1884, and it still remains on the spot where it was found, exposed to the action not only of the weather but of the water of an irrigation canal, and, moreover, to the risk of destruction by the carelessness or malice of any chance passer-by. A sum of 10,000 francs is needed to buy the inscription and to house it in safety in some more accessible spot. Subscribers of 25*l.* are offered in return a cast of the entire inscription. The object is certainly a worthy one. The inscription has been published with full commentary in the Museo di Antichità, and though it is, perhaps, stretching a point to call it "the most famous of the epigraphical remains of Greek antiquity that have come down to us," still its loss would be deplorable.

SOME interesting experiments were carried out at the end of last week at Argenteuil, near Paris, with a new explosive called Schnebelite, which is stated to be wonderfully effective in blasting stone, and to be at least 20 per cent. more powerful than dynamite. The base of the explosive is chlorate of potash, but the inventors have so tamed that dangerous substance as to render it quite safe to handle. After several rifle-firing experiments, comparative blasting tests between black powder and Schnebelite were made, eight charges altogether being fired. Large blocks of stone were selected for the purpose. We need not enter into the details; suffice it to say that with a much smaller charge, the Schnebelite did more execution than the powder, though the firing was not altogether satisfactory. One of the tests was carried out on a block of stone measuring rather more than 15 cubic mètres, when the new explosive broke it in halves, one half falling away, the other being smashed up where it stood into one large and a mass of smaller fragments. Judging from the results, we cannot say that we are altogether impressed with the value of Schnebelite for quarrying purposes. It will be exceedingly useful, no doubt, in mining, and in quarrying igneous rocks for road-metal, where the principal aim is to break up the stone as much and as rapidly as possible. As a means of ridding ragstone and hard overburden it might also do very well; but we are not so sure of its applicability in general quarrying operations. An enormous quantity of rock-powder is annually used in blasting granite for building purposes, and there is a good field open for the introduction of suitable explosives in that direction. The object of blasting the granite is two-fold; first, to split the material up into blocks of workable size, and, secondly, to detach it from the parent rock mass. To produce these effects, a slow-burning explosive must be used, which causes the rock to gently "heave"—to use a quarryman's expression—and to break in required positions. But quick-burning explosives of enormous power shatter the stone too much, and render it unfit for building.

WE printed last week a letter from M. Cervoni, Secretary to M. Trélat's "École Spéciale d'Architecture" at Paris, finding fault with the view taken by our Paris correspondent as to the motives of the Paris Municipality in withdrawing their grant from the school, and asserting that this action only arose from political motives. From what we have heard since we are inclined to think that M. Trélat and his secretary are mistaken in this idea. The fact that fifteen of the pupils who had obtained scholarships at M. Trélat's school subsequently went through the long course of the École des Beaux-Arts seems in itself sufficient to indicate that the pupils of the former school did not consider their education completed there; and, we are informed also, that out of 94 scholarship-holders of M. Trélat's school, between 1871 and 1891, only 26 are known as architects. Considering that M. Trélat's is a school where the education is paid for, it seems logical enough, without supposing any political considerations, that the Municipality of Paris should hesitate to continue giving subventions to it under the circumstances. M. Cervoni may of course be right; but it seems to us that the action of the Municipal Council is at all events quite intelligible on other grounds.

THE premises of the old Free Public Library in Great Smith-street, Westminster, have been acquired for purposes of the Church House, now in course of erection. The library buildings will, for the present, be used as offices and a hall, the latter having room for about 450 persons. They were formerly those of the Westminster Literary, Scientific, and Mechanics' Institution, founded, in 1840, on a scheme similar to that of the institution established, 1823, by Dr. George Birkbeck in Monkwell-street (disused) Chapel. The Westminster Institution was opened in Little Smith-street, and rented a large lecture-room in Vincent-square. The first members comprised some clerks and workingmen of the Esher-street Marble Works, and of Broadwood's piano-manufactory. Then the promoters were able to take a site in Great Smith-street, whereon a lecture-theatre and class-rooms below were erected after the designs of Mr. W. R. Gritten, architect, who gave his services gratuitously. In 1857 the united parishes of St. Margaret and St. John,

being the first metropolitan district to adopt the Free Public Libraries, &c., Act of 1855, leased the premises and equipment of the Mechanics' Institution, which, meanwhile, owing to unavoidable causes, had been closed. Amongst the most active of the Local Commissioners were Lord Hatherley, Dean Milman, and Archdeacon Jennings. Dean Stanley contributed 2,000 volumes, and his sister, Mrs. Vaughan, waived her life-interest, derived from the Dean, in 1,200 more, by giving the books in 1883. A branch library for the outlying part of St. Margaret's was opened (1858) in two rooms at No. 3, Trevor-square, Knightsbridge, where, thirty years later, the whole house with its garden, was obtained, and adapted by Mr. G. R. Welby Wheeler, architect. On August 21, Baroness Burdett-Coutts opened the new library in the same street, erected by Messrs. Stimpson & Co., after the plans and designs of Mr. Francis J. Smith, architect.

IN his own pleasant, but not always discriminating manner, Washington Irving records in "The Sketch Book" a visit he made to Charlecot. After describing the great gate-house, with its flanking towers, and the house's exterior, he takes us through several of the rooms, noting their contents. Of the hall bay-window, which faces an inner court, he says:—

"Here are emblazoned in stained glass the armorial bearings of the Lucy family for many generations, some being dated in 1558. I was delighted to observe in the quarterings the three *white luces* by which the character of Sir Thomas was first identified with that of Justice Shallow."

The proposed sale (as announced in a daily contemporary) of this property, which covers nearly 5,000 acres, in the course of next season, will evoke more than common interest. Sir Thomas Lucy rebuilt the house in the interval between Elizabeth's accession and Shakespeare's birth. It is ⊓-shaped on plan, has three floors with gables, four high octagonal turrets, and an elaborated stone porch. The material is red brick with stone quoigns and dressings; the style is that of the period. Sir Thomas, who was knighted by Elizabeth, and entertained his Queen here in 1572 on her return from Kenilworth, was descended from William, son of Walter de Cherlecote, who took the name of Lucy at the close of the twelfth century, and was founder of Thelesford Priory, near Charlcot. He died in 1600, his wife, Joyce Acton, five years before him. Their alabaster effigies and tomb in the parish church are ascribed to Bernini, who, however, was not born until 1598. Ferne's "Blazon of Gentry," 1586, gives the coat of Geffray Lord Lucy as *gules*, three luces hauriant *argent*. It is always a regretful matter to find a family finally severed from their ancient home, yet the Lucys and Charlcot are so closely associated with a generally credited incident of Shakespeare's youth (perhaps the turning-point of his career), and with the pasquinade and the three or four scenes in which he revenged himself upon the knight, that their united memory will endure until our own language becomes unknown.

WE have received through a well-known architect an amusing and enterprising circular from a gentleman who appears to keep an architectural studio for designing as well as drawing architects' work for them, and expects a great increase in patronage from the fact that he has caught a live French architectural draughtsman, to be kept on the premises and supply the superior artistic finish acquired "in the best Paris studios." It appears that under these fortunate circumstances a London architect has now no occasion to do anything but keep a neat office to see his clients in; all the rest can be done for him on the most reasonable terms. *Ex. gr.*:—

"*Schedule of charges* (subject to 25 per cent. discount for cash on delivery): Planning, designing, construction, and detailing all classes of work requiring ordinary skill, from rough sketches, 1s. to 1s. 6d. per hour.

Competitions.—Mr. . . . . is enabled to offer easy speculative terms for various public buildings he is expert in; ordinary engagements, 2s. 6d. per hour. Speculative 1s. nett, with share of premiums if successful.

Specially valuable aid rendered in planning, designing, and detailing, and specifying complete the following buildings, 2s. to 2s. 6d. per hour:—Technical and Board schools, public baths and washhouses, libraries and museums, Municipal and County Council buildings, hospitals and infirmaries, workhouses, factories, warehouses, offices, clubs, hotels and public-houses, houses and bungalows, flats, shop-fronts, &c.

Details (practical and artistic) in all trades, 1s. 6d. to 2s. per hour.

Decorative and colour schemes: perspectives by a French artist, from 10s. 6d. each.

Consultations—Mr. . . . is open to advising upon and revising competition and other plans, elevations, sections, and methods of construction before same are finally adopted and inked-in—without being otherwise employed—for a minimum fee of 2s. 6d. nett per imperial sheet. Telegrams dealt with immediately; all cases of urgency met by night work."

This is a delicate compliment to the English architectural profession which they will no doubt appreciate at its true value.

IN connexion with the Walsall Union Infirmary competition an architect has forwarded to us a letter from the clerk to the Union stating, in answer to an inquiry, that "the question of appointing a professional assessor is not yet definitely decided, but the probabilities are that one will not be appointed." It may be useful to intending competitors to take note of this.

THE lecture on "Adam architecture in London," delivered at the Society of Arts on Tuesday evening by Mr. Percy Fitzgerald, was a very interesting sketch of the career and work of a remarkable architect, and brought together illustrations (by means of the lantern) of a good deal of Adam's best work. We cannot, however, altogether go with Mr. Fitzgerald in the estimate which he formed of the architectural value of Adam's work. There is a beautiful refinement about his treatment of decorative detail of the class which he to some extent invented, or at least gave his own stamp to, but his designs for exterior façades, "correct" and elegant always, are with a few exceptions tame and cold in conception, and we should be very sorry to see the taste for this very formal style of façade revived, though we admit that something is to be learned from Adam's façades in the way of balance and proportion of parts. And though it may be true that the quality in architecture vaguely called "proportion" (a quality to be felt, but which no one seems able exactly to define) is comparatively neglected in many modern buildings, we cannot agree with Mr. Fitzgerald in considering the Victoria Tower one of these, and we should hardly have the hardihood to suggest that the architect of the Travellers' and Reform Clubs was deficient in the sense of proportion. In the course of the discussion we observed that the name of the architect was referred to constantly as "Adams," although "Adam-street" is just outside the building as a standing correction to this constantly-repeated mistake.

EXPANDED METAL LATHING.—The "British Metal Expansion Company" (West Hartlepool) have sent us a specimen of this, which is one of the best materials which has been devised as a non-inflammable keying for plaster and cement. It is made from thin sheets of the best steel, which are cut into narrow strips by a series of short parallel cuts, leaving a number of connecting pieces at equal distances; the whole is then pulled out sideways (expanded) into a network, the strips being turned in the process so as to present their edges obliquely towards the main plane of the surface. This network of strips of steel on edge makes an excellent key, and the whole sheet being ductile can be bent round beams or girders or wherever else required.

LETTER FROM PARIS.

IT is announced that an exhibition of objects which once belonged to the unfortunate queen, Marie Antoinette, is to be organised at Paris in the month of March, on behalf of a charity. For those who still preserve the taste for souvenirs of royalty and relics of the French Monarchy we may mention one well-known object which will have a prominent place in the proposed exhibition. This is the poor old armchair in Louis Quinze style, in faded crimson velvet, which was part of the furniture of the prison where the queen passed her last days. This chair, which has somehow escaped revolutionary vandalism and the cupidity of tourists, is now preserved in the office of the Director of the Conciergerie, and perhaps may be considered to be one of the most interesting of historic relics of the kind.

This is the time of private exhibitions. That of the Cercle Volney, as usual, opens the list of these small manifestations, in which real art is too often subordinated to the pretentious work of fashionable amateurs. M. Carolus Duran, however, exhibits two fine portraits, and there are others by MM. Bonnat, Benjamin Constant, Jules Lefebvre, and Machard. Among the landscapes the best are those of MM. Damoye, Yon, and Tattegrain; a pretty picture called "Primrose," by M. Raphaël Collin, and the "Pointe du Serail," of M. Bouchor, also merit notice.

There will open shortly, in the Rue Boissy d'Anglas, the exhibition of the Cercle de l'Union Artistique, to remain open till March 6. We may also notice in passing the private exhibition of M. Camille Maufra, whose drawings, heightened by colour, are manifestly inspired by Claude Monet. The pictures are supposed to be representations of Breton peasant character, but the "impressionisme à outrance" of their style is somewhat startling to the spectator who has preserved any vestiges of his critical sanity. Not less so are the landscapes of M. Armand Guillaumin, who exhibits at the Durand-Ruel gallery his ultra-revolutionary productions, which suggest the notion that art is becoming a form of disease, of more interest to the physician than the critic, save for an occasional glimpse of a fine effect of light which may arrest the scoffer for a moment here and there.

This year the Champ de Mars Salon, which is generally behind the old Salon, will open its doors first, on April 25 instead of May 15. The large ceiling which the Municipal Council of Paris have commissioned from M. Puvis de Chavannes for the grand staircase of the Hôtel de Ville will probably be found there. The subject of this ceiling is a kind of apotheosis of Victor Hugo. M. Bonnat, on his side, hopes to exhibit at the Champs Elysées Salon his "Apotheosis of the Arts," which will form the principal subject of the decoration commissioned from him for the same building.

Those who attend to-day (February 3) the first official ball at the Hôtel de Ville this winter, will have the first look at the remarkable work executed by M. Georges Bertrand for the decoration of the Salle des Banquets. The painting expresses, in allegorical fashion, the gratitude of Earth to the Sun as the source of life. Two smaller ceilings accompany this principal work. Not far from this will be seen, disencumbered of scaffolding, the ceiling by M. Henri Martin symbolising the Triumph of Apollo. Putting aside the peculiar method of execution which M. Martin has made a specialty, and which is a kind of painted mosaic of touches of various colours, one cannot refuse to this work the praise of fine design and colour and a true feeling for decorative effect. Unfortunately the purely ornamental portion of the ceiling is very weak, especially when compared with the work of the same class, near it, by MM. Galland and Guiffard.

Some days ago the Chamber of Deputies was occupied with the question of the Gare des Invalides, when M. Georges Berger, Deputy of Paris, represented to the Chamber the views of artists and the "Amis Parisiens" in condemnation of the proposal. After a rather animated discussion, the Chamber disposed of the matter in the following resolution:—"The Chamber, convinced that the Government will know how to satisfy the urgent necessities of transport in Paris, without doing any injury to the 'Perspective' of the Esplanade des Invalides, passes to the order of the day." This seem to indicate that, in spite of the numerous complaints that have been made, the end of the matter will be that the station will be made on the Esplanade des Invalides after all, but established among the trees, leaving the Esplanade itself intact.

Parliament has also had before it a proposition

for modifying the proposed reconstruction of the Opéra Comique, by forming the principal façade on the Boulevard des Italiens. This would be the best solution of the question, as it would permit of larger and more convenient exits, while at the same time allowing of a more dignified architectural development. But the houses on the boulevard must be acquired; and it seems doubtful whether the Chamber will vote the money for this additional expense, or will approve of disturbing the whole arrangement now that the competition has been adjudged.

The Government intends to take every precaution to put the scenery and decorations of the Opera House out of danger from any such catastrophe as that which recently took place. We should have had only to thank the indifference of the Department of Bâtiments Civils if the disaster had been a much more serious and extensive one. It was unpardonable to leave such a collection of fuel in the centre of a very populous district, two steps from the "Folies Bérgères," in a street as crowded as Fleet-street or Cheapside, with the addition that in this case the houses, five or six stories high, include numerous residences in flats, as well as shops and stores. The same danger exists in regard to the decorations of the Opéra Comique, which are stored in the Place Louvois and form a danger to the treasures of the Bibliothèque Nationale. All this dangerous material ought to be stored outside the city. The sale of the site in Place Louvois and Rue Richer would go far to cover the expense of new buildings, as well as the loss of the portion of the decorations already burned.

Another important question before Parliament is the rebuilding of the Cour des Comptes, which it was proposed to establish in the Pavillon Marsan of the Tuileries. The Finance Committee of the Senate, on the contrary, wishes to rebuild the Cour des Comptes on the ruins of the old building, placing the Pavillon Marsan at the disposal of the Union Centrale des Arts Décoratifs, which for sixteen years has not succeeded in securing any settled and final place of abode.

The Municipal Council of Paris has just voted the money necessary to complete the artesian wells commenced a long time since in the XIIIth Arrondissement, at the "Butte aux Cailles," and in the "Quartier de la Glacière." The works of the construction of the new Boucicault Hospital have at length been commenced. This establishment, in which the latest resources of medical science are to be brought to bear, was the subject of a public competition which was gained by MM. Legros, *père et fils*, architects, of Paris. The estimated cost is 2,000,000 fr. The hospital will comprise eight pavilions completely isolated, save for intercommunication by basement galleries ("galeries en sous-sol"). It contains sixty-two beds, and occupies 29,694 square mètres of land, or 9,000 mètres more than the Hôtel Dieu. It will face the Rue de Vouillé, in which the principal entrance will be situated.

At the cemetery of Montmartre the monument to Deslibes, the musician, who died three years ago, has just been completed. This monument, very simple but of fine architectural character, is the work of M. Jean Girette. It is placed not far from the tombs of the painter Greuze, the musician Victor Massé, and the poet Henri Mürger. It consists of a stone stele about five mètres in height, at the foot of which is a lyre with broken strings, over which are cast flowers and pages of music, containing brief quotations from the compositions of Deslibes, the names of which are also sculptured on the side faces of the stele, which is crowned by a small pediment containing a remarkably fine medallion portrait of the deceased musician by M. Chaplain.

We regret to add that the friends of M. Cavalier, the sculptor, are very uneasy as to his state of health, though he was believed to have recovered from the effects of his recent accident. We may remind the reader that it was to this sculptor, who has now attained the venerable age of eighty-seven, that we owed the fine statue of Francis I., in the Cour Louis XIV. of the old Hôtel de Ville, where it made a pendant to that of the "Roy Soleil" by Coysevox. These works fortunately both escaped the Communal flames, and are preserved in the Municipal Museum at Auteuil.

THE MASONIC LODGE FOR ARCHITECTS AND SURVEYORS.—More than fifty members and visitors attended the third installation meeting at Freemasons' Hall on the 24th ult. A banquet followed the business, and some music by Messrs. F. Bevan, Dalzell, and Coward.

THE ADVANCEMENT OF ARCHITECTURE.

ROYAL ACADEMY LECTURES BY PROFESSOR AITCHISON, A.R.A.—LECTURE I.

MR. PRESIDENT, students of the Royal Academy, ladies, and gentlemen: I began to prepare a course of lectures on Romanesque, the diagrams on the wall will show you how far they had progressed, but though I still think that the study of Romanesque is valuable, in showing us how the savages who overran the Roman Empire progressed in architecture, I became convinced that a continuation of last year's lectures might be more useful. I said something about the value of architecture to mankind in my last course of lectures, but I shall go over the ground again, for, unless students are convinced of the importance of their profession to mankind, they will hardly be impelled to give that time, energy, and devotion to its study, that its merits demand. I use the word devotion, to express the frame of mind that each student should bring to the study of architecture, in the hopes of advancing it for the benefit of mankind. A devotion that must not look to profit, honour, or fame in its pursuit, and only for that meed of pleasure which is spoken of by the poet, "there is pleasure in poetic pains that poets only know." Actuated by this devotion, which is at once benevolent and patriotic, he will emulate those philosophers who devote their lifetime to the examination and recording of some phase in Nature, which it is probable someone else will use.

The architect is even less fortunate than the poet, for it is a rare case when the poet cannot get his poem published. It is, however, common enough for the accomplished architect never to have anything to build which can show his skill; for should he be greatly in advance of his age, it is almost certain that any drawing or model he presents for approval will not be accepted.

The higher energies of mankind are now mainly devoted to the elucidation of the problems of Nature, and particularly to that grand problem of the ultimate atoms of which the universe is composed. These speculations were almost entirely abandoned during the early days of Christianity; necessarily in the dark ages, and during the enforced ignorance of Mediæval days.

Since the revival of learning, philosophy has again started from the speculations of the Greek philosophers, whose last exponent was Lucretius, about 55 B.C. The modern philosopher however has all the new sciences, chemistry, light, heat, and electricity to help him, as well as apparatus that more or less enables him to verify his hypotheses.

As "ignorance is the curse of God, knowledge the wing wherewith we fly to heaven," we should be grateful to the philosophers who pursue their profound studies with no hope of reward but the knowledge they gain, and who have shown us that Nature proceeds by unfailing and unswerving laws, and that all we can know is from the investigation of our universe. Such studies, however, should not so completely absorb the best energies of all the greatest of mankind, as to entirely turn away their thoughts from other things which should ennoble and delight mankind.

Some consideration of our universe is good for all, as a set off to man's overweening pride. It is good to be occasionally reminded that to our universe, man resembles the animalculæ in a drop of dirty water. Still, it is not good for man to wholly dwell on his own insignificance, as it is too apt to make him regard his actions as of no importance.

That an ant should appropriate to his own use a grain of corn, which it ought to take to the common store, does not seem of much importance to us, nor to the world; though it is of vital importance in an ant-hill; and our ant-hill is this earth.

As regards man, it must still be affirmed that "the proper study of mankind is man." Anything we can do to discipline, raise, and delight him with ennobling pleasures, is of more importance than to know the conformation of the circumambient ether. I consider that the triumphs of architecture do afford such ennobling pleasures to mankind, and I wish I could say with Sir Henry Wotton, that "Architecture can want no commendation where there are noble men or noble minds."

No one can expect to thoroughly appreciate even the outside shapes of fine buildings, without having some cultivation or some natural susceptibility to beauty.

Although it may appear scarcely credible, yet it is true that there are people who are unaffected by the beauty of inanimate nature, and we can scarcely expect such persons to be affected by architecture; though this may not always be the case, as man, cultivated or not, is mostly more affected by the highest and most enduring efforts of man, than by the works of Nature; for the one implies genius, knowledge, skill, power, and wealth, and the other seems but the spontaneous action of necessity. Those who do observe and admire the beauty of shape in rocks and mountains, in the sea and its shores, in trees, plants, herbs, and flowers, would naturally admire the fine shapes of buildings. I should not like to affirm that fine buildings, even the most beautiful, exceed in beauty the finest things in Nature, though I think they do; but they certainly bring home to us their relationship to man in the most charming and delightful way, and in a way that natural objects do not, however striking or beautiful they may be. When you see fine buildings in the midst of Nature, it is like hearing your native tongue spoken in a foreign land. In walking on the other side of the Thames by Cookham, you see a succession of all the beautiful and varied forms of the upper woods of Clieveden, and amidst them the outline of a pretty little pavilion, which goes to your heart at once, for it is man's work. In some respects, too, man's larger works exceed those of Nature even in size, for, as Mr. Ruskin has pointed out, there is no sheer plane in Nature that equals the front of a large building. In that pinnacled plain near Amalfi, that at a distance is taken for a Mediæval town, the biggest rocks seem much smaller than Gothic Cathedrals.

I believe the same is true of towers. There is no square isolated mass of rock that equals the bell towers of Italy, for though at Orkney the "Old Man of Hoy" is said to be 600 ft. high, it is but a ruin. The effect of that mountain at Utah that is called the "Western Temple of the Virgen Valley" is said to surpass all description; and, of course, Nature can deal with heights and masses that dwarf to insignificance the puny efforts of man. Yet Nature's chisels, heat, frost, wind, rain, and lightning, do not carve the mountains into shapes as dear to us, as those forms which the genius of man has erected for our admiration. Blind force, acting for ages beyond count on dead matter, can never excite the same admiration as that due to high intelligence working for man's delight. Hints, however, for all sorts of forms, and all sorts of arrangements, are culled by genius from Nature's works, but experience alone can show that these hints, when worked up, produce the desired effect.

We can never separate the visual effects from the mental rebound, that tells us whether these things have been done by man to raise emotions, or are but the outcome of blind necessity. Still we can only learn from Nature's and from man's works; and, as Nature's are the grandest, we get from them the rough-hewn sources of emotion, while from buildings we learn the devices for producing such emotions in less gigantic works. Height, vastness, and gloom, and the sudden change from dark to light, affect us all, whether they be produced by Nature's hand or by man's. Yet the thought of the power and originality of so small and feeble a creature as man, does much to enhance the value of his colossal works. Various and striking are the effects, and innumerable are the beauties that can be seen in Nature, and that can, by the efforts of genius, be used in man's work. Most persons when they look from a sunlit glade into a forest are delighted by the view of the numberless and vast branchless boles, gradually lost in grey obscurity; there is always a thrilling feeling of sublimity, in looking from the light into the impenetrable darkness of some cavern's mouth, and both these motives have been seized on and utilised, the former in the porticoes of Greek temples, and the latter in some of the vast porches of Gothic cathedrals, Coutances perhaps affording the finest example.

In architecture there is a recurrence, a symmetry, a rhythm, an ordered alternation of light and shade, of flatness and projection, and a delicate proportioning, that produces in us a calm feeling of delight; there are, too, the repeated alternations of contiguous light and shade that excite the eye, contrasted with smooth surfaces that give it rest, and in the occurrence of varied and contrasted forms, that make the æsthetic part of architecture particularly taking; but it is a vague and indefinite delight like music without words; but, as far as I can recollect, very few writers have noticed this special æsthetic charm. Madame de Stäel is one of the few writers that felt this charm. There is a passage in her "Corinne" that well expresses it, and that is almost unique in literature. When Corinne is standing by one of the fountains of the Piazza, and

looking at St. Peter's, she says:—"Painting and sculpture mostly imitate the human form, or, at least, some object in Nature, and, therefore, awaken in our soul perfectly clear and positive ideas; but a beautiful monument of architecture has not, so to say, any determinate sense; in contemplating it, one is overcome by that reverie without calculation and without aim which leads the thoughts so far. The sound of falling waters induces the same vague and profound impression; it is as uniform as the building is regular. 'Eternal movement and eternal rest' are thus brought together. In this place, above all, time is without power, for it no more stills these gushing waters than it moves those motionless stones."

Architecture, however, tells other tales besides producing vague emotions of delight; it tells of a nation's desire to perpetuate by monuments its feelings of adoration, its admiration for the glory it has achieved or the grandeur it has attained. These desires have in past time evoked the genius of the architect, and have enlisted the labour of the thousands of toilers, to embody his conception in hard and ponderous materials. Every vast monument expresses the desire of a nation to devote some of its earnings to the embodiment of an ideal, or at least its contentment that this should be done; for no tyrant exists, or ever has existed, except by the acquiescence of the bulk of those he rules. The heavy tax laid by Justinian on Constantinople to build Sta. Sophia, at least shows his people's acquiescence, or he would have been hurled from the throne. A philosopher says, all the reward and immortality of the unknown labourers at the Great Pyramid are enshrined in its stones.

Architectural monuments not only keep alive the memory of dumb nations; for without them what would now be known of the greatness of Egypt, Assyria, and Persia? But their monuments afford a measure of their wealth, power, and greatness; and give us the most concise compendium of the cultivation they had reached. It is, therefore, of the utmost importance that architectural monuments, besides their impressiveness and grandeur, should express the taste, feeling, and skill of the nation at the time of their building, and not be copies or paraphrases of former buildings. We should be as proud of what we can do, as Touchstone was of his bride: "An ill-favoured thing, sir, but mine own . . . for rich honesty dwells like a miser, sir, in a poor-house, as your pearl in your foul oyster." However admirable the architecture of former times, of other people, or of foreign climes, may have been, I trust that neither the architect nor the people want to be like the "jackdaw with the peacock's feathers"; but, besides this, if the architecture we paraphrase was of other climes, it cannot be proper for this climate; if it was that of other nations, it cannot exactly represent what ours should be; and if it were of former times it would still not represent what we now feel or most admire.

A passion for the newly-advanced geometry was one of the characteristics of the Saracens and Mediævals, but now, nothing can be more nauseating in the imitation Gothic of the day than the geometrical figures with which it is overlaid; for these only remind us of a child's efforts with a pair of compasses. If there is no desire for beauty in the people, and no original skill in the architects, it is at least honester to have a dead wall with holes in it, than the most brilliant fancy dress, in imitation of other tastes and other times.

Some day, when investigators have found out the diagnosis of architecture and sculpture, the capacities of a nation will be as clear to them from its architectural remains, as the shape of an extinct creature is to an anatomist, from the fragment of its bones. Most of us have wondered what the minds of the barbarians were like, who carved on their churches those ornaments, that look like the flock of geese Baron Munchausen captured with his line and eel.

The obtrusiveness of architecture is another of its characteristics, and not the least important one; buildings are not like books, statues, pictures, or musical instruments, that can be hidden away. In towns they meet us at every step, and compel some attention, even if it be but momentary. However small buildings may be, they take from us some light, some air, and the prospect; so they are not merely to be looked on as useful things for the occupier, but as things that owe everyone a debt for what they have deprived him of, and must be made sightly, if not comely. There are, however, exceptions to this rule, in the case of erections built by society to awe or terrify us, like police-stations, law-courts, prisons, and the gallows. Those buildings which dominate towns, and have been built for some noble or grand purpose, should declare their use. It is needless to point out their obtrusiveness, when astronomers tell us that if our side of the moon be inhabited, it is not by a race of great builders, for the telescope would reveal anything built there that was as high and as big as St. Paul's.

The building of a vast structure, even of an immense feature, involving a forest of scaffolding, huge heaps of material, and thousands of workmen, naturally impresses the people; so we read, in books of the time, of the domes of St. Sophia, Sta. Maria del Fiore, St. Peter's, and St. Paul's being called "mountains." We must consider, too, the effect that vast and magnificent buildings have on foreigners, and the notions they get from them of the greatness and civilisation of the country, not to speak of the wealth, magnificent buildings bring by the influx of visitors. Vast and magnificent buildings possess another power, which is not, however, pleasant to contemplate; the sort of limited immortality they confer on great nations that have perished. Even the ruins of such buildings speak of its former wealth, greatness, aud cultivation, and engender visions and regrets; as well as affording permanent records of the place where the great nation had its home. Books, pictures, statues, and other moveable works of art become either the property of the world or of the nation that possesses them; it requires an effort of the mind to refer them back to their native country, but the ruins of fine monuments fix the locality, and cannot be dissociated from the place. The mind, too, seems more ready to transfer the isolated works we have seen elsewhere, to the buildings we are contemplating. The ruins, too, of fine architectural works form a school for the barbarians who have settled there, and may eventually be the foundation for a new style.

Every building is so intimately connected with man, that it must be noticed by the poet, the writer, and the painter; for, except in the cases of battles, some building mostly forms the background to the most striking actions of man's life. Besides, the importance, the grandeur, the beauty, or sublimity of monuments has always made them favourite subjects for introduction by the painter and the poet. It would be difficult to find a poet not purely pastoral or didactic, in whose works admiration for fine buildings is not expressed, from Homer's description of the metallic palace of Alcinous, to the Palace of Art of the late Poet Laureate, though he unfortunately lived in the days of the Gothic revival.

The great poet of the Middle Ages, Dante, was born in 1265, just after St. Lewis was defeated and taken prisoner in the 7th Crusade.

Considering that Gothic was invented less than a century before Dante's birth, one cannot help thinking that, had he been much in France, he must have been forcibly struck by the wonderful buildings in the new style, and have written about them, even though his model, Virgil, took little notice of architecture. The great progress then made in Italy was, however, in sculpture and painting, and these were evidently the arts he mostly admired, for he composed in words charming groups of sculpture for the walls and pavement of the ascent to purgatory. He was, however, such a keen observer that he makes a simile of the burdened souls in purgatory from a corbel:—

> "As, to support incumbent floor or roof,
> For corbel, is a figure sometimes seen,
> That crumples up its knees unto its breast;
> With the feign'd posture, stirring ruth unfeigned
> In the beholder's fancy; so I saw
> These fashion'd, when I noted well their guise.'
> (Purg. Can. 10, l. 130–135, Carey's Translation.)

Chaucer, however, our fellow townsman,* who was born in 1328, seven years after Dante died, and who lived till 1400, was both an observer and an admirer of architecture, and describes buildings in many places rather minutely; and though his English is occasionally difficult to understand, and his verse quaint and rugged, there is a charm about it, so I give you his description of the House of Fame:—

> "All was of stone of berile,
> Both the castell and the toure,
> And eke the hall, and every boure,
> Without peeces or joynings:
> But many subtell compassings,
> As babewinnes and pinnacles,
> Imageries and tabernacles,
> I saw, and full eke of windowes,
> As flakes fallen in great snowes;
> And eke in each of the pinnacles
> Weren sundry habitacles,"
> (Chaucer, "House of Fame," Lib. 3, v. 93.)

* He is said to have been a Londoner.

I may say that "babewinnes" are baboons; the writers of the Middle Ages irreverently called grotesque Gothic sculpture and painting "babcon work."

The architectural descriptions in the poets, even including Wordsworth's "Vision," mostly contain only a few vague terms, costliness of material mostly doing duty for beauty of design; which, after all, cannot be properly dealt with in words. Milton's language is, however, so sublime, that we can well bear his description of Satan's golden Renaissance palace:—

> "Anon, out of the earth a fabric huge
> Rose like an exhalation, with the sound
> Of dulcet symphonies and voices sweet,
> Built like a temple, where Pilasters round
> Were set, and Doric pillars overlaid
> With golden architrave; nor did there want
> Cornice or Frieze, with bossy Sculptures grav'n.
> The roof was fretted gold."
> —Milton's "Paradise Lost," Lib. I., v. 710.

* * * *

If all the architecture were to be erased from sculpture and painting, and blotted out of literature, what gaps would be left in pictures, bas-reliefs, and books; think how bald even the Arabian Nights would become, without the architectural surrounding of the stories. So I think we may consider that architecture fills a good space among the achievements of mankind. Is it not well worth the devotion and striving of the architects, and the aspirations and efforts of the students, to put it once again into the way of improvement and progress? Although Architecture now brings no honour, glory, or fame, mankind may again turn to admiring it, as at former epochs. Future architects may become as famous as Ictinus, Callicrates, and Mnesicles, as Anthemius of Tralles and Isodore of Miletus, as Giotto, Brunellesco or Bramante, as St. Gallo, Palladio, or Wren. We must, however, admit that Milton was right when he called fame "that last infirmity of noble mind," for truly the world has received as much instruction and delight from the work of nameless Roman, Gothic, Saracen, and Renaissance architects, as from those who stand in the temple of Fame.

Building we could scarce do without, to protect us from the weather, and from robbery, to stow our goods in, or to work up our materials, unless we fell back into primitive savagery. If we pretend to any culture, we want our commonplace buildings to have character and comeliness, and those for noble purposes to raise strong and adequate emotions, for if all buildings were wholly and purely utilitarian, it would be like exchanging oratorios of the great composers for the din made by the rivetting of iron ships.

All the fine arts are necessarily progressive, but their strongest appeal to us is when they portray the emotions of the day. Sir Walter Scott pointed this out in his Waverley novels; he said that he had made all the accessories as true to the time as he could, but not the personages, for had they represented the real persons, no one would have cared to read the novels. To make his personages interesting they spoke, acted, and thought like those of his day; and this is true of every fine art. There was a simplicity, a directness, an intensity, and a dignity about all the historic personages of Greek times, that has made antique poetry, eloquence, sculpture, and architecture unsurpassed, and possibly unsurpassable. The artists, and, under this name I include the poets, of to-day have to deal with people who are feebler and less dignified, but more varied and complex than the ancients; but now, as then, existing personages must be the actors, and must be made like life, or their works must appeal to present emotions, or they do not interest us. As long as noble qualities, character, and beauty exist in nations, I believe there will always be artists to express them. The art of expression is mainly learnt from the past, but the artists must be animated by the spirit of the present. The cause of Tennyson's works being so highly valued, and so widely spread amongst the English-speaking race, is, apart from their harmony and beautiful diction, due to their being imbued with the knowledge, thoughts, feeling, and aspirations of his day. There have been times of brutal barbarism, there have been times of vileness, corruption and cowardice, that could give rise to no poetry. Architecture only deals indirectly with man, it has to meet some of his necessities, habits, and artificial wants, and æsthetically to move those emotions that are proper to the uses of the building.

If any fine art had ever arrived at a perfection, that would be appropriate for all purposes and for all time, that art would be done with, there could be nothing more to express, and we could but apply the stereotyped form to what we want. This perfection has by no means been reached in

architecture, it is difficult to see how it ever could be arrived at, while man's wants and knowledge progress, and his tastes change; though unhappily we too often act as if this were the case. We have many new necessities, thousands of new wants, and many new materials, that must have new proportions, and somewhat new forms, and certainly new methods of construction; we have new beliefs, new knowledge, and I think I may safely say new hopes and new aspirations, though these hopes and aspirations may be vague. It can hardly be said that we have availed ourselves of all these changes from the past, though we may be slowly working to bring about a very different order of things in Architecture. Those who are familiar with the ways of Nature know that the gradual subsidence or the gradual elevation of parts of the earth's crust are usually too small to be observed until the lapse of centuries. All we can say about Architecture is, that it has received in our time no sudden and immense development; it has not been affected by one of those tremendous volcanic eruptions that has suddenly changed a level surface into a mountain, like that, which in Renaissance days, filled up the Lucrine lake.

In the very early Renaissance days there were apparently but few architects in Italy, and the scholars, antiquaries, goldsmiths, painters, and sculptors, thought they had found perfection in ancient Roman architecture, and in the precepts of Vitruvius; in consequence Architecture then ceased to be a progressive structural art. We have not altogether shaken off this Renaissance fallacy, although we have several times changed the model. Greek, Gothic, and the Dutch Renaissance have successively been held to be the acme of perfection.

My object is to consider if Architecture can get into a progressive state again, and if possible how it may be done.

I could fill the whole of my lectures with the facetious diatribes of non-professional writers against modern architecture and architects, if I thought any benefit would be gained by so doing. All architectural archæologists know the slow evolution of the different architectures, now called "styles"; an evolution that it has mostly taken many centuries to effect; yet these critics write as if they thought it was mere sloth or perverseness, that prevented clever men from inventing new styles in an hour, a day, a week, or a month. So the main use of such quotations would be to show the critic's ignorance, and even if it showed a real and earnest desire in the country for something new, it would only illustrate the theory of political economy, that it is the supply that creates the demand and not the reverse.

We must, however, admit with due regret that as yet there is no architecture in Christendom that in our eyes can be called good, true, and distinctive of the present century.

All those engaged in rapidly progressive fine arts, have treated with contempt the work they have surpassed, as men of science do exploded theories. The Greeks at their apogee used their old statues as rubbish to fill up holes, the Mediævals used carved Norman stonework as raw material, and carved on its back, and the Saracens did the same with some of their carved woodwork. While such is our humility, that a large portion of the profession is engaged in restoring old buildings, or in building imitations of the past. The same may be said of some of the sculptors and painters, in regard to Gothic statues and stained glass.

If we wanted any confirmation of this, we have only to look at a modern architectural guide-book to an English town; we shall there find the different buildings described as Greek, Roman, Byzantine, Romanesque, Saracenic or Moorish, Norman, Early English, Geometrical, Perpendicular, Tudor, Elizabethan, or Renaissance. To get a popular opinion of the absence of any distinctive style of the day, you have only to tell anyone that no past style should be used, and he will ask, with well-marked surprise, what can be done, if it be not Classic, Gothic, or Renaissance?

This, perhaps, is not the worst phase, for not only is the architect looked on by the public as a supplier of old fancy dresses for buildings; but too many architects are of the same opinion. The architect, in too many cases, is believed by the public to be like a comic actor whose business it is to parody all the expressions of former national character, from Greek to Chinese, and not to give expression to our own.

Archæology is a charming science, of great interest to every one, and of the very highest importance to the historian; but it is not only not architecture, but, when it is used as a substitute, it is fatal to it. Progress is the watchword of architecture, but with the archæologist it is the unpardonable sin. The architect's business is to improve on the past, the archæologist's to reproduce it, no matter how bad or ugly it be. The architect's canon is, that every part of a building is to be good in itself, and help to produce the proper effect. The archæologist's canon is to have precedent—*i.e.*, that the modern building has been taken direct from one built ages ago; the architect of those days may have been ignorant, may have bungled, may have spoiled his building, but the archæologist is satisfied, perhaps delighted, if you can exactly reproduce these bungles.

It is surely worth the deepest thought, earnest and vigorous striving, and strict self-denial to get architecture again on the line of progress, if it be possible. I by no means say that it is possible, for the wheel of fortune turns, and Science, that in Mediæval days was in the mire, is now at the top of the wheel, while Art is in the mud. We have, however, this advantage over the Mediævals, that, whether we be successful or not, we shall not be burned alive for trying, though we may starve. Even when to be suspected of dabbling in Science meant the chance of the dungeon, the rack, and the stake, the votary of Science would study it. We have, too, some encouragement for trying, for Greek art and Greek science flourished together.

Democritus, the founder of the Atomic theory, was a contemporary of Phidias, and Epicurus lived in the days of Alexander the Great, when the Temple of Diana of the Ephesians was rebuilt by Dinocrates. As far as I know, there is no *a priori* reason why Art and Science should not flourish together, although in latter times we know they have not. We should now think it absurd for eloquent writers on Science to advocate the worship of the rushlight, when we have the Argand lamp, gas, and the electric light; but in Art we are in that unhappy position, that some of the highest eloquence of the day is devoted to the worship of the rushlight, and to the prophecy that it can never be surpassed. The eloquence we want must dwell on the inestimable benefits architecture confers, and should point to the invention of the electric light as an instance of what well-directed effort has attained. A fixed idea that no advancement can be made is fatal to all progress. So long as Ptolemy's theory was accepted as the ultimate truth, no progress was, or could be made in astronomy; but when Copernicus, Kepler, and Galileo invesitigated the matter, they proved that the earth was a spheroid that revolved on its own axis and round the sun; and since their day, not to speak of Newton's discovery of the law of gravitation, the knowledge of astronomy has been constantly increasing.

All the architectures that we now call "styles" could never have come into being if each nation had determined that Greek architecture was perfection, and no improvements in arrangement, construction, or æsthetics could be made. With considerable gaps there was a regular advance, at least in construction and arrangement, from Greek to Mediæval times; it was left to the Italian artists of the Renaissance to start a belief that Roman architecture was perfect, and that all mankind could do was to try and restore it, with the effect that architecture has hardly moved from that day to this. Many observers have been sagacious enough to see that architecture is practically stationary, though the fashions have been constantly changing; but it was only quite lately that the reason, or one of the reasons, for this has been discovered—that is, that the method was wrong. The Gothic revivalists were eloquent enough, and brought the fiercest invective to bear on the Roman and Greek models, but while they advocated the change of model, they were quite contented with the method.

The question is, how are we to get the genius, capacity, skill, knowledge, and taste—if there be any taste—of the present day mirrored in our architecture? It is true we have the sculptors and painters to help us, but they can give us nothing of the present, but animal and vegetable life; for the clothing of the day, and the attitudes and groupings of the people, are neither sculpturesque nor picturesque.

As regards architecture itself, we must, I think, make up our minds what we want; and these wants are twofold: material and intellectual. Let us take the material wants first. Do we want a high-pitched roof for snow to slide off, or a moderately pitched roof for rain to run off, or a flat roof? If we have a flat roof we cannot reasonably have a gable, and perhaps not a cornice. It is difficult to say whether a dome is to be looked on as a material, or an æsthetic, want; in a hot climate a dome not only gives increased air space but looks as if it did, and may be useful to let in light high up, though a lantern will generally answer both purposes. It has been stated that this Byzantine feature was adopted by the Saracens, as reminding them of their umbrella-shaped tents, which, if true, is an æsthetic reason; but as to whether the dome is wanted to be best seen from the inside or from the out, is certainly an æsthetic question. If it be wanted to compose with the inside, it forms no striking external feature, while if it is to be an external feature it will not compose with the inside; you merely see a gap, until you are under it and look up.

Everything that is palpably unreasonable in a building is a blot. We can to some extent, by care and knowledge, arrange that we have nothing wrong in constructive shape, in area, or in arrangement; but all this, I fear, will not produce a building that raises high emotions; but, on the other hand, we know what emotions the use of most buildings ought to evoke, and that is something. It is obvious that if we were to follow a strictly reasonable method, without any thought but for utility, we should probably produce buildings that were very different from the existing masterpieces of architecture. Nature, in making everything purely for use, makes most things shapely, and occasionally makes them beautiful, but we by no means have Nature's gifts in this respect. If we use, as we must eventually use, iron and steel for those parts which are to bear great weights, great strains, or to bridge wide spans, and made the ironwork visible, we should not only find that these materials would take new shapes, but must give rise to new ordinances. Iron pycnostyle, systyle, eustyle, and aræostyle would be very different to those of marble columns with marble architraves. Shapeliness in iron must be reached by new proportions, and its enrichments must be different from those in marble on account of the exigencies of the material. Horizontal girders being the most convenient form that iron will take, vaulted ceilings will be superseded by flat ones, and flat roofs will be substituted for high-pitched ones.

All the large iron buildings yet put up, have been merely for temporory or commonplace purposes, and have mostly been rapidly and cheaply done, to meet some sudden requirement. They have not been called for by the nation for the purposes of magnificence or for the highest ends to which buildings can be devoted; and so have scarcely entered the pale of æsthetic building. Sheds for the mere protection from the weather of people, animals, trees, or goods, are not wanted or expected to raise any high emotion, but if, as we all hope, the whole bulk of the people improve as much in intelligence, morality, and cultivation as they have materially, we may look forward to vast structures, not only "built for pleasure and for State," but dedicated to still higher purposes. When we have so wonderful a material as iron to our hand, the mind almost shrinks from contemplating the possible sublimity of buildings designed for the nation by the highest talent, and for the purpose of exciting the highest emotions. We picture to ourselves their colossal size, their novelty, and beauty of shape, their perfection of composition, and the exquisiteness of their detail, glowing, too, with the colours of enamel, while each building is gloriously adorned with sculpture and painting. Even now, the inside of the Crystal Palace is one of the most striking buildings in the world, although there was no attempt at building anything beyond a vast greenhouse.

I have the greatest possible confidence in the rising architects of the day, if they be not led astray by false teaching, or demoralised by the desire of becoming rich. They have seen, by travel, many of the past triumphs of our art, and, by photographs, almost all the existing architecture in the world. They have in one respect distinguished themselves above the students of all other professions by their thirst after knowledge; for they have not only taxed themselves to get it, but organised the only complete Architectural School in the kingdom. As far as they know how, they have used every exertion to acquire that deep and varied knowledge that is wanted for the most exacting profession that exists.

I doubt if the world has ever seen a failure, when all have been striving to do their utmost, and it is at such times that genius mostly makes its appearance. Themistocles emerged between the first and second attempt of the Persians to conquer Greece, and Publius Cornelius Scipio i the high tide of Hannibal's conquests.

If it be allowed to compare the present con-

dition of architecture, of architectural aspirations, and of architectural instruction with another time and a different desire, it may be said that Italy in the thirteenth century was precisely in the position that English architecture is now, for then, throughout the length and breadth of Italy, each poet studied all the poetry he could find, and strove to create a language in which he could enshrine the stirring thoughts and actions of his time; and eventually Dante appeared. It was at the end of such a time, among a galaxy of poets and playwrights, that Shakespeare was born. If our nation continues to cultivate the virtues of wisdom, courage, temperance, and justice, whose practice has carried it so far, we may hope that it will shortly want splendid buildings for the noblest ends; and if the architects and students are still as eager, energetic, and persevering are they now are, that the great architectural genius will shortly arise who is destined to carry architecture on its new path; that by that time the nation will have seen the supreme importance of architecture to mirror its greatness, its virtue, and its culture, so that he may be able to create buildings worthy of his genius, and to found a school that will give to the world a succession of buildings of a vastness, an impressiveness, and an exquisiteness, that will cast into shade and insignificance all the architectural triumphs of the past. G. AITCHISON.

THE ROYAL INSTITUTE OF BRITISH ARCHITECTS.

THE seventh ordinary general meeting of this Institute was held on Monday last at No. 9, Conduit-street, Mr. J. Macvicar Anderson, President, in the chair.

The minutes of the previous meeting having been taken as read,

Professor Kerr read a paper entitled:—

Observations on the Plan of Dwelling-houses in Towns.

After touching on the radical importance of good planning—for of what avail would be the strength of Hercules, the symmetry of Adonis, the splendour of Apollo, with a rickety organisation within?—Professor Kerr referred to the English dwelling-house as professing to be, in respect of plan, the best in the world, home comfort being its special characteristic. The organic arrangement of a dwelling-house began and ended with the idea of home or family comfort. The great difference between the house in the country and the house in the town was that in the one case the accommodation was conveniently spread out over the proper extent of ground-space, while in the other it was so squeezed together laterally that it flew up into the air. Height became the substitute for breadth, and rooms which would naturally be disposed side by side had to be artificially piled up tier upon tier. This crowding was what constituted the town, and, as we knew that all forms of crowding of animal life produced pollution of the air, it followed that a town became so far an unwholesome place of habitation. He remembered a suggestion once offered in public by an eminent physician—namely, that one of the principal causes of the disappearance of the great cities of antiquity might have been that the inhabitants were driven away by the intolerable pollution of the soil.* Crowding must, in the very nature of things, bring with it the evils of crowding.

In the organisation of a plan it was not enough to account for a certain list of rooms, and to provide them all of such dimensions respectively and with such relations to each other as should be on the whole not unacceptable; this was little better than the old-fashioned mode of the Vitruvius Britannicus, by which the house was endowed with an academical exterior and a symmetrical interior, and the occupants were left to settle down in it as they best could. The skilful architect nowadays would include in his plan the furnishing of every room; in imagination he would personally occupy every corner, pass inwards and outwards through every doorway, and consider the precise interior effect and lighting-value of every window. The symmetry and stateliness of an academical plan—on paper—were always attractive; but, in modern English dwelling-house plan of a high class, considering the extreme complexity of the accommodation, this paper simplicity was fallacious. The only efficient test was to follow out the full detail of actual family occupation.

As to the plan of a town, it was of no use to direct attention in England to the question what the plan of a town ought to be. Every one of our towns had initiated its own plan by chance, and developed it in its own way on the same principle. The leading lines were the accidental roadways of ancient traffic, and the enlargement of the place had been governed, from time to time, by the demands of business. The story of Regent-street was an interesting illustration of the achievement of a great public improvement, and what had come out of it. The houses were designed in a manner which was deemed adequate for their stately situation. But now, when only three-quarters of a century had passed over them, how had they come to be regarded? Two half-miles of very shabby little shops, below the mark of many a new third-rate street, marvellously made the best of, but cumbering the ground; scarcely worth their ground-rents but for the exigencies of the locality, the showy shop-fronts, and the spacious dignity of the roadway; the wonder being that they survived at all! In about five-and-twenty years the Regent-street leases would fall in *en masse*—and what was to be done then? The problem which the Crown agents would have to face was not merely how to appraise high ground-rents, but how to rebuild at all without disorganising a considerable proportion of the trade of London! He would respectfully suggest the possibility of beginning to rebuild forthwith, by simply announcing a readiness to entertain whatever private proposals might be offered piecemeal, upon certain general terms that could easily be formulated; and then, he believed, there would be a brand-new Regent-street to show long before the twenty-five years were out, not only as a great benefit to the public and the town, but equally to the advantage of the Crown estate.

In the classification of town houses, the first or leading class of dwelling-houses in any large town was obviously the street house, one of a close row where mere standing room was economised to the utmost. Although it was impossible for him to go into details of plan, there were two points in respect of our ordinary street houses upon which he might say a word. He was entitled to assume, for instance, that every architect instinctively shaped his rooms aright, and disposed their doors, windows, and fireplaces in proper relation to each other; but why must he scamp the entrance-hall, degrading one of the most important items of residential convenience and pleasantness to the level of a rabbit-hole? And why, again, attach the title of "bedroom" to haphazard chambers without ever thinking where even the bedstead is to stand? The first step in designing a street house of any importance, was to prepare a list of the required rooms, with their approximate dimensions, and to proceed to classify them by area of floor-space, so as to be equally divided between the requisite number of stories. Take the case of a good house, in a fashionable quarter of London, worth about £7,000, five stories in height, and occupying about 2,000 square feet of ground within the walls. The scheme of arrangement might then stand thus: On the basement floor, kitchen and scullery, larder and store-room, butler's pantry and bedroom, housekeeper's room and servants' hall, wine and beer cellars, knife-house, closets, &c., corridor and back stair, with front area and vaults for coal and dust. On the ground floor, dining-room and servery with lift, library, gentleman's room and billiard-room, porch and entrance-hall, cloak-room, and lavatory, principal staircase and back-stair. On the first floor, drawing-room and morning-room, principal staircase and gallery-landing, conservatory, a bedroom suite and bath-room, and back-stair and service with lift. On the second floor, principal staircase, bedrooms and dressing-rooms, nursery suite and school-room, bath, &c., linen-room, and housemaids' closet, with lift and back-stair. On the third floor, bedrooms, back-stair with lift, servants' rooms, bath, &c., and housemaids' closet, and a lumber and box-room. He would have the entrance-hall wide, well lighted, and warmed: and the billiard-room top-lighted, if only by means of a projecting end with a glass roof. A special corner of the plan ought, of course, to take practically all the water-served accommodation. The nurseries would be adapted for use as bedrooms. The back-stair must be sufficiently lighted; and he saw no objection to an internal area for light and ventilation otherwise. He did not object to the good old principle of having the entrance door in the middle, with rooms right and left. Moreover, he would insist upon the back wall of the house being as well designed as the front; and the rear ground, however small, ought to be pleasantly laid out for actual enjoyment.

The suburban house, properly so called, was in principle a country house. In good examples it ought to have no basement offices; and even a second story of bedrooms ought to be limited in extent, or, if possible, avoided altogether, except, perhaps, for servants' rooms: that was to say, the house ought to cover ground as liberally as circumstances would allow; for it had escaped from the crowd of the town, and could take no excuse for being stinted of anything in reason that belonged to open space.

Convenience was the foremost question of residential organisation; the elementary arrangement of the vital apparatus or mechanism of the dwelling, by means of which *it would go*, while the equally substantial and perhaps more handsome house next door, having been planned anyhow, *would not go*.

The English idea of domestic comfort depended very much upon privacy, especially as to the complete separation of the family from the servants, a rule which applied to every house, however small, that came under the category of a "gentleman's house" in England. He had seen it argued that this was obsolete conservatism, or aristocratic pride; but we had professionally to plan a house for the prosaic facts of housekeeping; the family as one class demanded and were entitled to their own privacy, and the servants as another class demanded and were entitled to theirs.

As to aspect and prospect, it was useless to suggest that the element of aspect, all-important as it was in the open country, should be materially considered in the streets of a town.

But in a suburban house both aspect and the diffusion of light and air must be fully considered. One or two points in planning might be mentioned: We ought never on any account to have a dark staircase. Let us always make our hall as spacious as possible, and as bright and airy. Again, we must never light a room by the very common means of a pair of windows with a broad pier between them. Thousands of handsome dining-rooms were spoilt in this way; the shadow of the pier eclipsed the whole room; and when the artifice was resorted to of disguising it with a mirror, this almost added insult to injury.

The semi-detached house was a hybrid between the more crowded street house and the more open suburban; and as such it constituted nowadays a favourite class of ordinary, and sometimes expensive residence for the extension of our towns. But he failed to see any real advantage that it possessed, except when on a small scale, over the wholly detached house. The saving in ground-rent was open to question; and as for the party-wall, of all our structural contrivances, the domestic party-wall was one of the least felicitous.

In regard to homes for the working-classes, there were to be seen in and about London several distinct types of commonplace working-people's dwellings which were easily identified as the simple outcome of their habits. First came the independent cottage or very small street house, containing a living room and a small kitchen on the ground floor, and two corresponding bedrooms above, with a little yard or garden behind. Secondly, an occasional range of houses with an open gallery running along the front at each floor level, for access to so many tiers of lodgings, smaller but still independent. Thirdly, the "model lodging-house" so called, or block-building, divided internally into small suites, accessible from dismal public staircases. Fourthly, the inferior, but most common and perhaps most popular form of lodgings, in which an ordinary street house, with the usual two rooms on a floor, accomodated a separate household on each story, with perhaps more quietude if less privacy. Lastly, there was the same kind of house, or any other kind miscellaneously, which was let out in a rough-and-tumble way to the poor, and most generally in single rooms. The first of these orders of dwellings, the independent cottage of two floors, seemed to him the most desirable of all. Of course, it was really a country type; but in the suburbs, even of London itself, he saw no reason why it should not be the general rule. The second model, with the galleries, was to be commended for such quarters of the town as were more crowded, especially if private little balcony yards could be added behind. The large block buildings he disliked, and thought the inmates must dislike them. With reference to the dwellings of the inferior poor, many years ago he read a paper there which advocated the systematic supply of homes for the poor in the humble form of spacious single rooms, specially planned and provided with appropriate appliances, simply to take the place of the insufficiently large and

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* It seems certainly possible that this may be the end of London. And there can be little doubt that the unhealthiness of Rome and its neighbourhood is to some extent caused by the saturation of the soil with decayed and polluted matter from ancient Rome, though that was not the immediate cause of "the decline and fall of Rome."—ED.

decidedly haphazard single rooms which they now occupied. He still thought this was one solution of the problem.

The system of residential flats seemed to have now effected a settlement in London; and, commercially speaking, the speculating builder, and none the less perhaps the speculating dealer in building land were no doubt making a good use of the element of ground-rent; but socially also there were certain attractions offered fairly enough to residents of several classes. However, it was easy to see that the popularity of such peculiar establishments must come in time to turn very much on questions of salubrity, and in this respect medical men were beginning to complain of them. The paper concluded with some general remarks on designing an English house, which were more or less a recapitulation of precepts laid down many years ago by the author in his book on "The Gentleman's House." In regard to the question of the picturesque, Professor Kerr remarked that the bric-à-brac Renaissance of the present moment would be found to be quite evanescent, in fact only a stepping-stone from the discarded picturesque of the Secular Gothic of five-and-twenty years ago towards some much more appropriate Renaissance of five-and-twenty years to come. The best compliment that could be paid to the miss-called Queen Anne style, or Flemish Rococo, was that it was clearly a Teutonic, and not a Latin, mode, and therefore on our own side of the racial dividing-line; but how far this was sufficient to confer upon it a historical value of its own was another question. There were only two foreign models to which he would allude—the French and the American. France exhibited in perfection the type of plan which in England we had left behind us; while America illustrated what seemed to be before us. A private residence of the best class in Paris was a highly-refined example of advanced Italian or Neo-Grec Renaissance, academically designed, both without and within, for artistic grace, but organised more for stately and often grandiose effect than for what we considered to be family comfort. On the other hand, if we turned to the United States of America, what we saw in domestic architecture was of special interest. There was great activity, a good deal of miscellaneous ambition, considerable promise in respect of artistic character, and—this being the point that concerned us at the moment—a certain amount of that kind of utilitarian enterprise which conduced to progress in interior organisation. It could not be said that the English mansion was being improved upon as regards its plan, or, indeed, that it was yet emulated; but the practical and empirical inventiveness of the American intelligence seemed to be likely to engage itself in the suggestion of novel appliances in such matters as drainage, heating and cooking without gross waste of fuel, contrivances for ordinary ventilation, the smoke nuisance, the use of gas, electric lighting, the water supply and service, the freezing of pipes, fireproof construction, the use of lifts, and so on, and we must confess that if the Americans, as they were always saying, accomplished results while we were thinking over preliminaries, we should be only too glad to have the benefit of such promptitude if they would seriously turn their attention to the wide field of domestic contrivance.

A communication was then read by the Secretary, Mr. White, from Mr. Arthur Cates, in reference to Professor Kerr's suggestion that the rebuilding of Regent-street might be facilitated by the Crown authorities simply announcing their readiness to entertain whatever private proposals might be offered piece-meal upon certain general terms which could easily be formulated. A course of procedure such as that so suggested would be only in accordance with the practice which had been generally adopted on the Crown's London Estate for the past twenty-five years, under which proposals for the surrender of existing leases, which might have comparatively short terms to run, and the grant of new building leases to facilitate the consolidation of holdings, and the substitution of one good building for several of inferior type had been favourably considered, and under such arrangements many of the important buildings of late years erected on the Crown Estate had been rendered possible, all subsidiary interests in the smaller buildings removed having been extinguished. The Queen's Concert Hall in Langham-place was one of the most recent instances of the advantage gained by the surrender of outstanding leases, and the grant of a new building lease for the consolidated site. As regarded Regent-street, on December 17, 1877, in opening the discussion on the paper on "Middle Class Houses in Paris and Central London" by Mr. William H. White, now Secretary of the Institute of Architects, he dealt with the subject of Regent-street, and the great benefits conferred on the metropolis by the magnificent improvements carried out by the Crown in forming that street, Pall Mall East, King William-street, West Strand, &c., and especially commented on Mr. White's suggestion that a particular block of property in Regent-street—an "island" as he termed it—the reconstruction of which he advocated in accordance with his views of the arrangement proper for business and residential houses in Central London, being—"Crown or national property is above the law; so, for more years than I can live, it must remain beyond all possibility or hope of improvement in the direction to which the make-shift alterations of the actual tenant unmistakably point." The responsible managers of the Crown Estate had but one anxiety—to promote the welfare of the property and of its occupants, and were at all times ready to meet those who might be in a position to effect these improvements. He further said that if Mr. White had a client prepared to surrender all interests in the island he referred to, the Crown would be happy to afford all possible facilities for the removal of the houses now standing, and the granting of a fresh term of lease for the erection of his combined dwellings. However willing and desirous the Commissioners of Her Majesty's Woods might be (with due regard, of course, to the interests of the Crown) to encourage and carry out such arrangements more extensively than had yet been possible, there were great difficulties to be overcome especially in regard to the Regent-street houses, where, besides the valuable trade interests involved, the real obstacle to the desired improvement was the web of legal restrictions in which most of the properties were entangled by settlements and the like devices, which tended to keep the improvable unimproved, and check in every direction all efforts for development—obstacles which appeared to be almost insuperable, except with the aid of empowering legislation specially aimed at them. There were other considerations which must greatly influence dealing with Regent-street. Any rebuilding such as advocated by Professor Kerr could not be of single houses, forming a mere narrow strip of elevation, perhaps well enough adapted to form a bold advertisement of the business of some individual tradesmen, but to secure the necessary architectural effect must be in blocks, and where such block was not an island or of isolated design, due regard also must be had to the surroundings of the property to be dealt with, and any such dealing with The Quadrant would clearly be inexpedient, but wherever it might be practicable to rebuild without erecting a deformity the proposal of those persons who, in the opinion of Professor Kerr, were not only ready but anxious to find the money to rebuild Regent-street entirely would certainly receive the most careful consideration of the Commissioners. How far the extreme restrictions on building and rebuilding in London, contemplated by the London Streets and Buildings Consolidation and Amendment Bill, now being promoted as a private Bill by the London County Council, would affect the monumental rebuilding not only in Regent-street, but throughout the metropolis, was a subject which should receive earnest consideration from the Institute as a matter of grave importance likely to seriously affect the interests of architectural and of business development.

Mr. Lacy Ridge, after expressing his appreciation of the paper, referred to the London Streets and Buildings Bill, and stated that the Practice Committee and their sub-committee had had the matter under their consideration for a very long time, not only since the Bill of the London County Council was brought out, but for years before, the Practice Committee having drawn up a Bill of their own, on which, in part, the Bill to be brought before Parliament was founded. The present Bill did embody a good many of the suggestions which emanated from the Practice Committee, and that, he thought, should make the Institute look very favourably upon the action of the County Council in having brought forward a Bill for the amendment of the numerous acts which now affected building in London. At the same time neither that consideration nor any other could possibly blind them to the extreme danger to the property of the individual in many of the enactments which it was proposed to embody in the Bill. What action it would be necessary for the Institute to take on the matter hereafter was now under consideration. In conclusion he proposed a vote of thanks to Professor Kerr for his paper.

Mr. John Slater, in seconding the motion, said the difficulties of buildings in towns were only appreciated by those who had to do with the planning of such buildings. One of the greatest difficulties which he experienced was to arrange for the continuance of houses which were quite inadequate to the requirements of the town, for the sake of carrying out a larger improvement when the leases of other houses immediately next to them were falling in in two or three years' time. He had come to the very decided conclusion that it was undesirable to take two or three small houses in such streets as Berners-street and Newman-street, and rebuild those, when the leases of other houses adjoining fell in shortly. One ofthe greatest difficulties they could experience was the dealing with the corner sites. In a great many cases corner houses were small and inadequately provided with light and air at the rear. If they could possibly manage to get two or three more houses on either side, and carry out a large, comprehensive scheme, they would do better than by attempting to rebuild any corner house by itself. The question of workmen's dwellings had received a certain amount of attention from himself, for he happened to have erected two large blocks of such buildings not far from the Marylebone-road. Undoubtedly they could, by careful planning, erect buildings which could be substantially built, well arranged with good sanitary accommodation, and with a fair amount of light to all the rooms, in order to pay a very good interest for the money. He alluded to those buildings for the better class of working men. But undoubtedly the great difficulty was, what to do with the extremely poor people. That was a problem which he did not think had been sufficiently considered, and he was quite sure it had not been solved. He thoroughly concurred in what was stated in the communication of Mr. Cates as to the great difficulty in dealing with any such property in London, caused by the entanglement of settlements and various other things. On the Berners estate they were only too pleased and anxious to grant new building leases if people would surrender their present interests; but sometimes these interests turned out to be three, four, five, six, and even seven deep, and it was almost impossible to buy them out. With regard to the shopkeepers' houses, Professor Kerr had mentioned how completely the conditions of living had altered. This was most strikingly shown in many of the houses on the north side of Oxford-street, which were planned and built as shops and residences. Only ten days ago he had to go over one of those houses. The whole of the area had been covered with pavement, the staircase had been taken down, the access to the upper rooms was through the shop, and the dining-room for the assistants had not one single particle of daylight coming into it. That was a state of things which they found in too many cases in Oxford-street, and there could not be the slightest possible doubt that the sooner those conditions were terminated the better for the people who had to live in these houses.

Mr. J. J. Stevenson said the difficulty in the planning of the town house was this, that they got a block of, perhaps, 60 ft. deep and 21 ft. wide, with no light except at the two ends. How they were to light up that block in the centre was the one great problem of house-planning. He observed that the plans exhibited had mostly avoided that difficulty, their authors no doubt sending their more important buildings with more light all round. That plan of a London house had a regular historical development from the time of King Stephen, when that proviso of the London Building Act which insisted on all party-walls was first introduced. There was one thing which he thought was wanted to make the London house, with its seven stories, really fit to live in, and that was a passenger lift. House-agents objected on account of the cost, and lest people should think them dangerous, but they worked with perfect safety and success in many houses, and their cost was balanced by saving a servant.

Mr. Aston Webb thought all the members would admit that Regent-street was one of the finest and most successful streets that London had ever had in the way of the grand lines on which it was laid out. Seventy-five years hence they could hardly expect that Shaftesbury-avenue or some more modern streets would hold their own as well as Regent-street did to-day. Professor Kerr had spoken of the academical plan. Of course, the academical plan did not enter so much into private houses as into public buildings. He took it that what was wanted even in the

town house was some little mystery in the plan. A good deal of improvement might be made in the arrangement of the windows; very often the windows were made too low down, and it was a common thing to see the lower part filled with screens. Probably a very picturesque effect could be got by keeping the cill of the windows a great deal higher, and running the window nearly the whole width of the room, and so getting the light in a horizontal line instead of in two or three vertical ones. There was a charming example of something of that sort in one of Mr. Norman Shaw's houses at Queen's Gate, plans of which were exhibited that evening.

The President said the very wide nature of the subject Professor Kerr had treated rendered it difficult to concentrate remarks, even if one were disposed to criticise where there was so little room for criticism. He had impressed upon them the extreme importance of avoiding overcrowding in all planning, and in securing a sufficient supply of fresh air. The importance of this could not be over-estimated in regard to a new departure in planning in London, namely, that of flats. Professor Kerr had directed their attention to the fact that doctors had recently impressed upon the occupants of flats the danger they incurred from the want of fresh air, and possibly the insalubrity of being closely packed, but this remark, it appeared to him, applied equally well to the vertical system of planning as opposed to the horizontal. If a flat was properly planned, with a sufficient supply of light and fresh air, there was no reason in his judgment why it should be more insalubrious than a building constructed on the vertical system. This question of the proper supply of fresh air to the City of London might be taken as the keynote of the proposed Consolidation Amendment Building Act. The Institute had for years advocated the passing of such an Act, and therefore they had every reason to wish the London County Council well in carrying out a good and efficient Act of this description. Some of the principles of the Bill were such that, unless modified, they could not concur in. Although the motive was admirable, the securing of a sufficient amount of fresh air and light, yet the means by which that was to be effected in a city like London appeared to him to be perfectly chimerical.

The vote of thanks to Professor Kerr was then passed with acclamation.

Professor Kerr, in reply, said the request for plans to be exhibited on that occasion had been so singularly successful that he thought the Institute might contrive to have similar exhibitions on future occasions.

The President announced that the next meeting of the Institute would be held on Feb. 12, when papers on "Mosaics and Fresco" would be read by Mr. C. Harrison Townsend, Mr. J. C. Powell, Mr. G. Salviäti, and Mr. N. H. J. Westlake.

ENGINEERING SOCIETIES.

JUNIOR ENGINEERING SOCIETY.—The ninth anniversary dinner of this Society took place on the 27th ult. at the Holborn Restaurant. Mr. J. Wolfe Barry, the President, was prevented by illness from being present, and the chair was accordingly taken by Professor J. Perry. After the loyal and patriotic toasts, Sir P. Magnus, in proposing "The Senior Professional Institutions," said that, as far as his observation went, engineers were mostly conservative in feeling as well as in politics, and yet there was no profession under the sun which was so democratic as that of the engineer. It was the main object of the engineer to level things. His great works were shown in making crooked paths straight, in driving roads under mountains, and in preparing a way over the deepest chasms and the broadest rivers.—Mr. Giles, President of the Institution of Civil Engineers, in responding, said that the world was more indebted to engineers for the advance of civilisation than to members of any other profession. He referred to the progress that had been made of recent years in telegraphic communication, in the speed of ocean steamships and railway trains, and expressed a doubt as to whether any man who had attained eminence in his profession had been content to confine his working day to eight hours.—Professor Perry also responded.—After the toast of "The President and Past Presidents," which was proposed by Mr. H. J. Young and acknowledged by the Chairman, Mr. A. R. Binnie, Chief Engineer to the London County Council, gave that of "The Junior Engineering Society," dwelling upon the importance of giving scope to the faculties of observation and imagination, as well as of taking the benefit of experience in the acquirement of scientific knowledge.—Mr. S. H. Wells, a former Chairman of the Society, responded, and the toast of "The Visitors" brought the proceedings to a close.

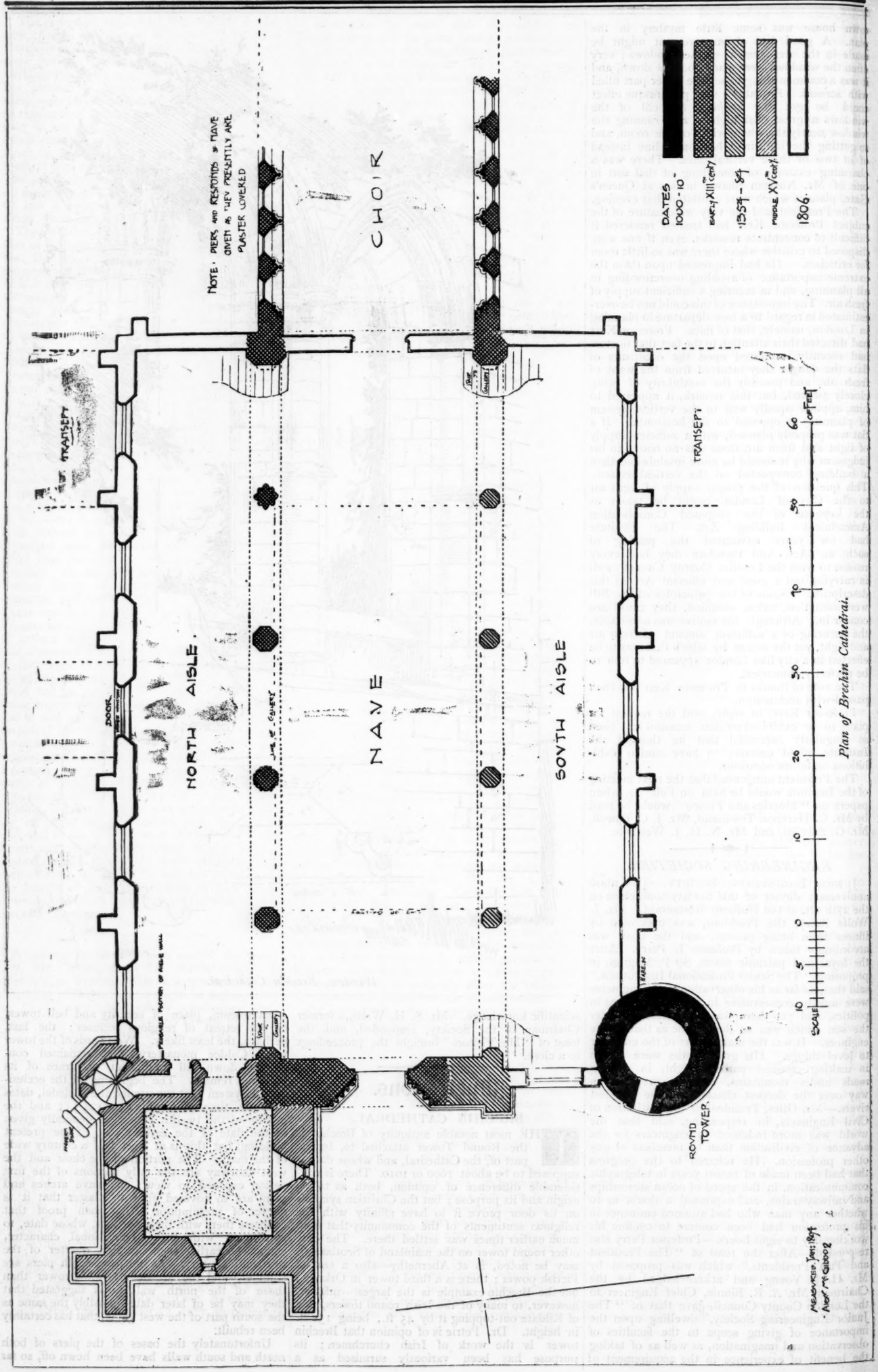
Window, Brechin Cathedral.

Illustrations.

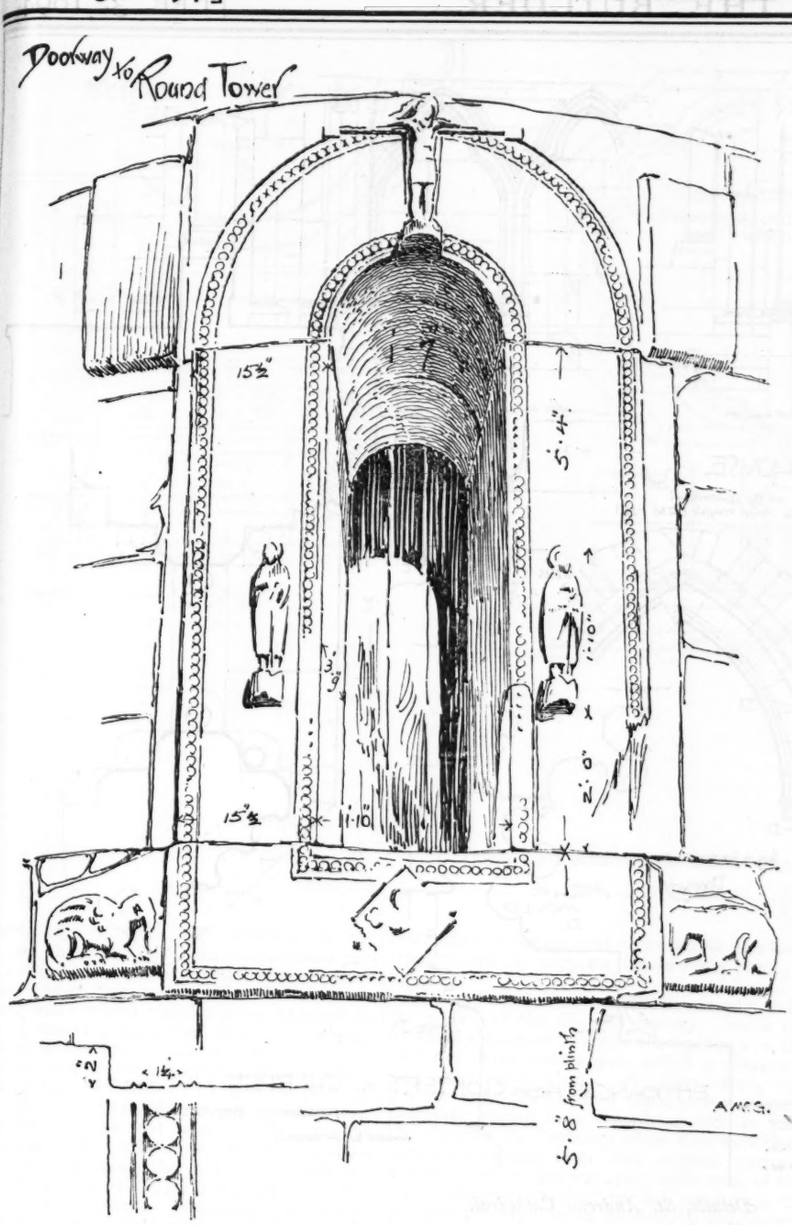
BRECHIN CATHEDRAL.

THE most notable antiquity of Brechin is the Round Tower attached to, but no part of, the Cathedral, and whose date is supposed to be about 1000 or 1010. There is considerable difference of opinion, both as to its origin and its purpose; but the Christian symbols on its door prove it to have affinity with the religious sentiments of the community that from much earlier times was settled there. The only other round tower on the mainland of Scotland, it may be noted, is at Abernethy—also a seat of Pictish power; there is a third tower in Orkney; but the Brechin example is the largest—inferior, however, to many of the Irish round towers, that of Kildare out-topping it by 45 ft., being 132 ft. in height. Dr. Petrie is of opinion that Brechin tower is the work of Irish churchmen; its purpose has been variously surmised as a mausoleum, place of security and bell tower, or the retreat of religious recluses; the last, perhaps, the least likely. Westwards of the tower lay a Culdee monastery, that remained constituted down till 1248, but no trace of its buildings remain. The beginning of the ecclesiastical system that superseded the Keledei, dates from the time of David I., 1124-53; and the middle of the twelfth century is generally given as the date of the earliest part of the present building, but this is at least half a century wide of the mark. The portion of the choir and the west doorway are the only portions of the first period exposed to view; the nave arches and piers are so covered up with plaster that it is matter of presumption rather than proof that connects them with these portions, whose date, to correspond with their Transitional character, cannot be earlier than the first quarter of the thirteenth century. As the nave south piers are slimmer, and the arcade above narrower than those of the north wall, it is suggested that they may be of later date—possibly the same as the south part of the west gable, that has certainly been rebuilt.

Unfortunately the bases of the piers of both north and south walls have been hewn off, so far



Plan of Brechin Cathedral.



Door, Brechin Cathedral.

at least as the pews permit of so much of the bare masonry being seen.

Thus it would seem that this cathedral church, dedicated to the Holy Trinity, in its original state consisted of a choir without aisles, and of a length that cannot now be determined —though Walcott states it to have been 84 ft.— and a nave of five bays, with side aisles, of widths less than the present ones: the south appears to have quite cleared the round tower, and the north one to have been not more than 11 ft. wide; there may have been a north porch. It is unlikely that these aisles were vaulted; the choir and nave centre aisle could not have been. When, at the beginning of this century, the church was remodelled, north and south transepts were swept away. Their wall-heads do not appear to have been higher than those of the aisles; the position of their roofs is yet marked on the nave walls, the ridge just under the wall-head there, but from the fact that the pitch is marked by a coarsely-cut raggle or chase rather than a properly-formed weather course, and that one of the clearstory windows must have been blinded, we may conclude that these transepts were not part of the original plan, but may have been added when the south aisle was rebuilt or when the tower was erected. Some mishap has befallen the building, and so occasioned the rebuilding of the west gable, the doorway only escaping. In the new work built south of it a niche has been introduced, over the door the thickness of the gable is reduced, and in it is placed a window with flamboyant tracery. Later the bell tower and steeple was added; if we may judge by very similar work at Dunkeld, not earlier than the middle of the fifteenth century. The ground floor chamber, most likely used as Chapter House, is vaulted; a subsidiary rib there is noticeable as simply planted on the vault without marking any change in its form. The ribs are plainly splayed, and spring from corner capitals that are of much earlier character than the rest of the building. The door connecting with the north aisle is splayed on jamb and archmould; by its side is a small door to the turret stair. Though not exposed for verification it seems likely that the original aisle wall came hard against this door. The Tower, above the ground level, has several stories; the finish of the masonry internally is very good; in all, apparently, the apartments have been considered of importance. Up at the start of the broaches are carvings; in three of the angles, of foliage, but in the north-east corner a well-executed dog picking a bone. On the cope of the parapet appears the date 1624, and this may truly apply to that exact part, but the parapet proper is earlier; the cornice on the west face is carved. The height of the tower is 70 ft., of the octagonal steeple 58 more. In the steeple are hung three bells, none earlier than the sixteenth century. Recently a small handbell of thirteenth-century date has come to light, of round form, and beaten. The turret is finished also with a detached spire; the view of the tower that includes this turret is much the best. Of about the same date as this tower and steeple was the Bishop's Palace, that lay east of the Cathedral, built by Bishop Carnock, 1429-50, of which, however, only a few fragments remain, incorporated with modern houses.

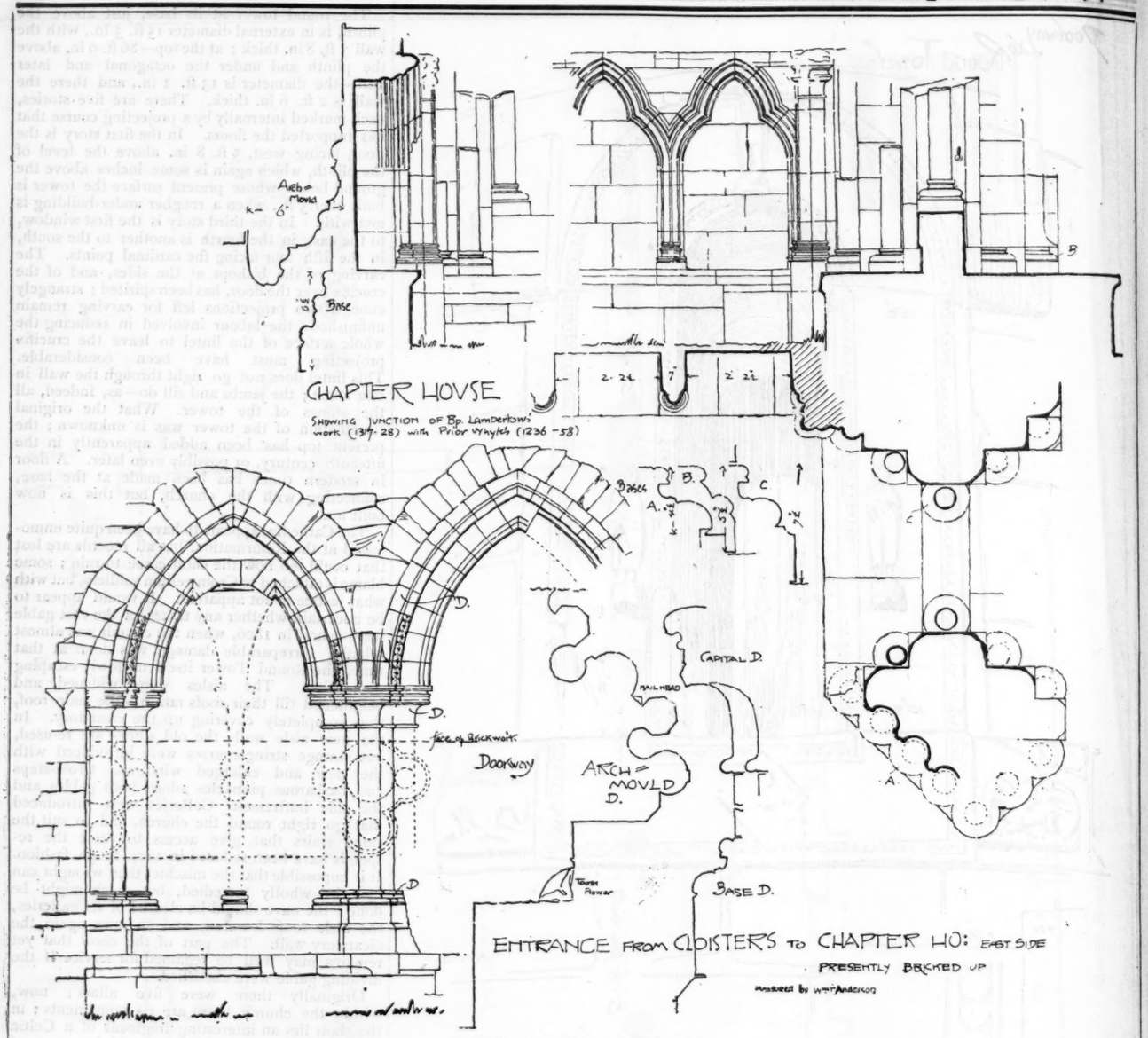
The round tower at its base, just above the plinth, is in external diameter 15 ft. 3 in., with the wall 3 ft. 8 in. thick; at the top—86 ft. 9 in. above the plinth and under the octagonal and later part—the diameter is 13 ft. 1 in., and there the wall is 2 ft. 6 in. thick. There are five stories, each marked internally by a projecting course that has supported the floors. In the first story is the door, facing west, 5 ft. 8 in. above the level of the plinth, which again is some inches above the ground below whose present surface the tower is built over 5 ft., when a rougher under-building is met with. In the third story is the first window, to the east, in the fourth is another to the south, in the fifth four facing the cardinal points. The carving of the bishops at the sides, and of the crucifix over the door, has been spirited; strangely enough two projections left for carving remain unfinished; the labour involved in reducing the whole surface of the lintel to leave the crucifix projecting must have been considerable. This lintel does not go right through the wall in one stone; the jambs and sill do—as, indeed, all the stones of the tower. What the original termination of the tower was is unknown; the present top has been added apparently in the fifteenth century, or possibly even later. A door in modern times has been made at the base, connecting with the church, but this is now built up.

The Cathedral appears to have been quite unmolested at the Reformation, but all records are lost that could tell how the choir came to ruin; some blame is attached to Cromwellian soldiers, but with what justice is not apparent. It would appear to be uncertain whether any traces of the east gable were extant in 1806, when the church was almost rebuilt. Irreparable damage was done at that time, the Round Tower itself narrowly escaping demolition. The aisles were widened and heightened till their roofs ran into the main roof, thus completely covering up the clearstory. In the new aisle walls the old stones are re-used, but strange string-courses were introduced with the new and enlarged windows. Crow-steps and barbarous pinnacles adorn both gables and the side buttresses. Galleries were introduced that go right round the church, and to suit the stone stairs that give access to these the responds have been reduced in very rough fashion. It is impossible that the mischief then wrought can now be wholly remedied, but much might be done; the nave should be cleared of its galleries, the aisle roofs lowered, and so open again the clearstory wall. The part of the choir that yet remains may well be regained for service if the dividing gable were abolished.

Originally there were five altars; now, within the church, there are no monuments; in the choir lies an interesting fragment of a Celtic sepulchral slab. From the centre of the nave roof hangs a brass "hearse," a chandelier for candles, now supplied with gas, presented by Bishop Lamb, 1606-10, one of the reformed Bishops; it was originally hung by a chain, weighted with a stone for balance, for lowering at pleasure. The church also possesses some excellent communion silver plate, all beaten work. The local book of reference is the "History of Brechin;" David D. Black, F.S.A., 1864.

ST. ANDREWS CATHEDRAL.

THE traveller Slezer, who made a tour through Scotland towards the end of the seventeenth century, prefaces his work on her architectural remains with a comparison of their excellence even when measured with Continental examples. "There is no country in Europe can brag either of greater piles of buildings, or a more regular architecture in its ancient churches and religious fabricks, than Scotland was mistress of about an age or two ago. To instance, once for all, the Metropolitan church of St. Andrews was probably the biggest in Christendom, being 7 ft. longer and 2 ft. broader than that of St. Peter's at Rome; and for the height and embellishing of its pillars and roof, the beauty of its stones, and simetry of its parts, was one of the best Gothick kind in the world." This eulogium, general or particular, is hardly borne out, but undoubtedly of Scottish ecclesiastical buildings St. Andrews was the most important in size—being over 70 ft. longer than Glasgow Cathedral, and by the same amount exceeding Kirkwall in length of transepts, while in point of merit not much inferior to the best. Unfortunately its present condition is one of complete ruin; not a fragment of vaulting remains, the walls in many places only appear above the ground, in others the very foundations have been removed. Still sufficient remains to permit of an exact idea being formed of the extent, and proves



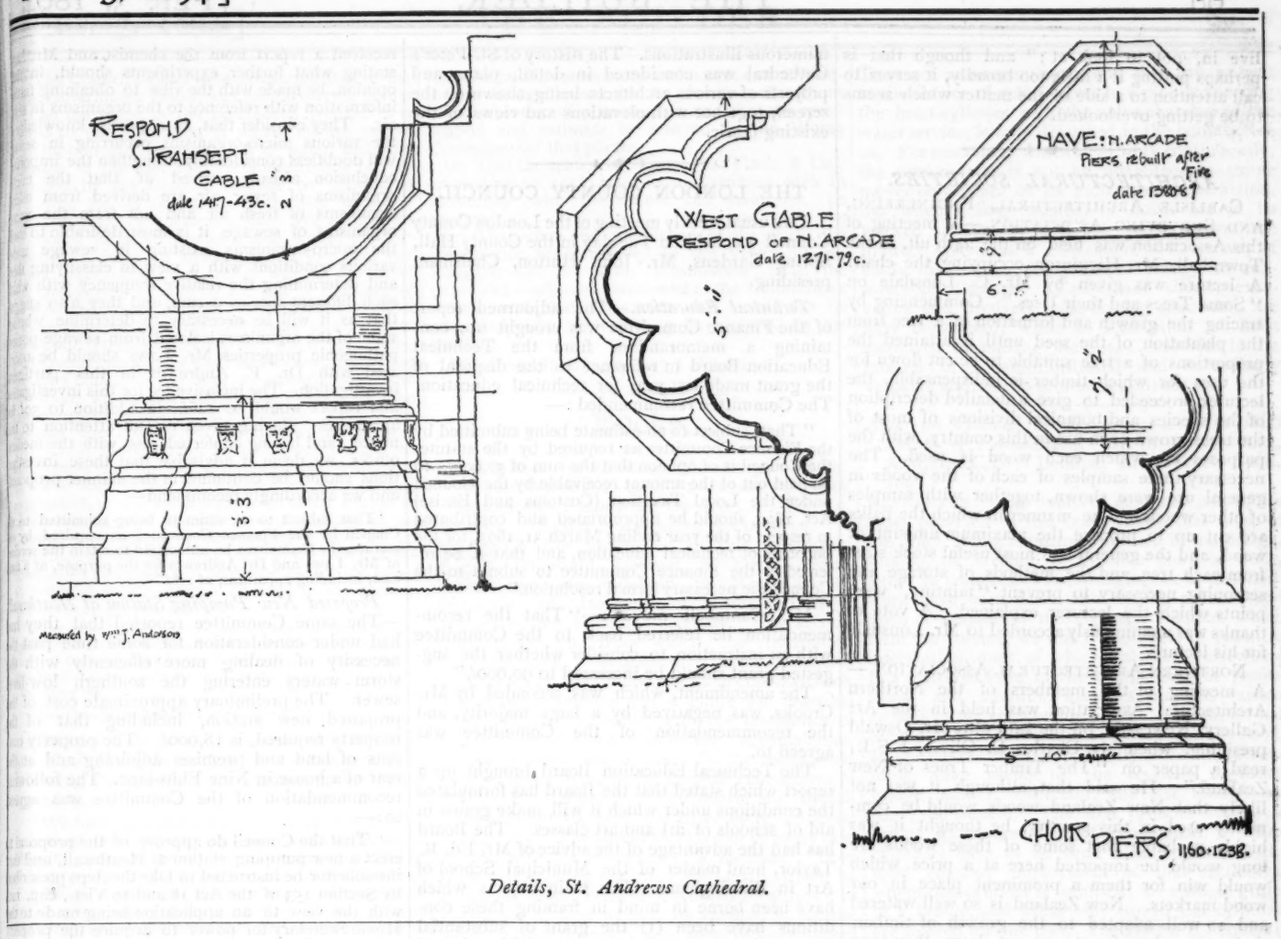
Details, St. Andrews Cathedral.

the arrangement to have been of quite a normal type. The building consisted of a long narrow nave of twelve bays, north and south transepts of three bays each, with eastern aisles; a tower at the crossing; and a choir that for five bays of its length had aisles, but beyond that the central alley extended and formed a Lady Chapel. South of the church lay the cloisters and the rectangular Chapter House, entered through a large square vaulted vestibule; adjoining was a vaulted sacristy. The conventual buildings included a refectory, calefactory, kitchen, lay brethren's quarters, &c., with dormitories over. These buildings denote the peculiarity of this cathedral church; it was conjoined to a monastery. The Abbot was also Bishop; next in rank was the Prior, and in the case of St. Andrews his office was a most important one, owing to the closeness of its connexion with the primacy of the realm, added to the wealth of his monastery.

The traditional origin of the Christian faith at St. Andrews is that Regulus, a Greek monk, was in the fourth century guided to the spot, bearing with him relics of the Apostle. Investigation discredits this account; and even the more circumstantial one that gives the credit to St. Kenneth, a contemporary of St. Columba, finds little favour. The opinion is now held that the true founder was a bishop of Hexham, who, in 732, had to flee his country, and, journeying northwards, found safety in Pictland, and there founded a bishopric. The facts of Bishop Acca's leaving Hexham and his founding a church seem certain; and Whithorn, in Galloway, has generally been designated as the place of his sojourn; but the probabilities of dates tend rather to favour the belief that St. Andrews was where the Northumbrian bishop settled. Though Saxon influence originated this northern church, for two centuries the officers were native, the names of the bishops for that period being Celtic; but towards the close of the eleventh century English influence revived in Bishop Turgot, a monk of Durham, and Confessor to Queen Margaret. In 1124 Bishop Robert, another Englishman, founded a Priory of Canons. Even before Turgot's time the Keledie or Culdee Church had greatly deteriorated, many of the offices in it having become hereditary; but within it had arisen a reforming party, whose aim was to revive stricter discipline and Regular monastic life. In time there was a severance; each section retained a part both of temporalities and spiritualities; but the influence of the English bishops, and latterly the Crown, was with the new party, who gained ground, and within forty years of their establishment the priory of Austin Canons was formally possessed of all that had belonged to the reformed section of the earlier community. The methods by which the canons imposed their principles on the Keledie of the island of Lochleven, gifted them by royal favour, were distinctly oppressive and arbitrary. Yet the Culdee Monastery continued; their original church on the Kirkhill, not many yards north-east of the present cathedral, in mere outline is still preserved; the members for a time exercised their right of participating in the election of the bishops, but their feebleness permitted them to be overborne, the privilege was denied them, and their protests disregarded; their name disappears from all records by 1332.

The church and tower of St. Regulus that adjoins the Cathedral is supposed to date from about the beginning of the twelfth century, possibly even earlier, and is believed to have served the purpose of a diocesan church separate from that belonging to the monastery. It consisted of a western tower, small nave without aisles, and an apsidal chancel, now gone. Later an addition, also gone, west of the tower, was added, for the use, it is presumed, of the newly-founded priory. In this church of St. Regulus, until 1202, successive bishops were buried. The square tower is the loftiest of the five ante-Norman ones that Scotland possesses; all contained, too, within the adjoining counties of Perth and Fife.

The present Cathedral church was begun in 1160 by Bishop Arnold, who formerly had been Abbot of Kelso, and so possibly had some share in the erection of the church there, thus accounting for the undoubted resemblance that the later bears to the earlier building. The portion first completed included the choir, transept—with the tower at crossing—and three bays of the nave, and seventy-eight years was occupied in the operation. And though in that time the style elsewhere had progresssd, Arnold's original design was adhered to; and even for long afterwards, when the style was changed, the early proportions were retained in the close centreing of the nave arches; to the end narrowness and height were relied upon for the architectural effect. Bishop Malvoisine, who had the distinction of so far completing the church, was the first prelate buried within its choir north of the high altar. In 1236 new monastery buildings were begun by Prior Whyte, but these have been replaced later; of his work there only remains the vestibule to the Chapter House, that originally itself was the Chapter House, and the sacristy; that is in the buildings of the monastery proper, for a little way distant remains yet the noble Guest Hall, also the work of this energetic Prior. In 1264 there was added to the monastery a common hall. During the episcopate of Bishop



Details, St. Andrews Cathedral.

Wishart, 1271-79, work was resumed on the nave and thereafter continued, considerable progress being made before the interruption caused by the War of Succession. After Bannockburn building was resumed under Bishop Lamberton, when it would appear that then the original intention as to the extent of the nave was modified: and the west gable is now seen to be a couple of bays or so east of its intended position. That this is the result of an afterthought is further proved by the gable not being bonded into the aisle walls. The marks of vaulting evident on its west face may mean that a Galilee porch was intended, if not added, utilising thus the aisle walls that remained projecting westwards. Record is made of much carving of bosses in the vaulting and insertions of capitals; those of the nave aisle-wall yet remain, but of softer stone; they are now much weather-worn. A greater work of Bishop Lamberton's was the building of a new and larger Chapter House, the existing one being retained as vestibule; thus in 1318 the church with its Chapter House stood complete. In 1340, under Prior Williams, additions and reparations to the monastery building followed; the cloisters were re-roofed, the refectory and other parts repaired; he also added furniture to the church. In 1378 befel a great mishap, a fire that would seem to have affected most disastrously the nave; so much may be inferred from the three bases of piers there that alone remain; as the mouldings agree with the date of the rebuilding that was at once begun, we may believe that the destruction of the nave-roof involved the north wall, at least, of the nave as well. A rhyming-translator repeats Boeces' too-romantic account of the crow that, flying with a lighted twig, occasioned the fire. The choir is known to have been vaulted, but whether at the general re-edification after the fire or later, is uncertain; the great angle buttresses at the east end were certainly added by Bishop Haldenstone, 1419-43. The gable is seen to be rent from top to bottom, the result of the vault thrusting at a place where there were no aisles to resist it. Possibly by way of repair, rather than from mere desire of architectural magnificence in the style current, the small early windows were replaced by the large one. Most likely at the same time the conical terminations to the east gable pinnacles were added, and possibly, too, the respond in the south transept, necessitated by some collapse or weakness of the arcade there. Before this time the tower itself, showing signs of weakness, had been strengthened by supports, whose lower parts yet remain.

The cathedral was then finally completed by the middle of the fifteenth century. As for the monastery, when or by whom the buildings on the west side of the cloister were added, is unknown, they have now almost all disappeared, the position and dimensions of the refectory are only positively known from records so late as 1685 that describe the buildings when they were then partially alienated from their original purpose. The fine vaulted gateway, just south-west of the Cathedral, known as the "pends," was built in the fifteenth century; more precisely is not known. In 1516-20 the great wall surrounding the monastery grounds, and which abuts against the east gable of the Cathedral, was built by Prior Hepburn. It is quite an important work in itself, having several watch-towers and gateways. There has been a corbelled battlement: the niches and other embellishments are seen to be in some cases made out of fragments of earlier carved work. In 1466 St. Andrews was raised to the dignity of an Archbishopric, and claimed the obedience of the twelve bishoprics of Scotland. The first prelate, the unfortunate Patrick Graham, accepted office against the wishes of the King, who confined him to the island of Lochleven, where he died. How it came about that this Cathedral and Monastery, once so complete and so extensive, should now be a ruin, is generally explained by a reference to Reformation zealots, but this is quite insufficient; their fury only affected the monuments and church furniture and decoration, the fabric was uninjured. The true reason is apparent—the inherent weakness of the structure. The tower and nave north aisle specially were not over stable: outside the latter, opposite every pier, are foundations that prove supports to have been required. Dislocations at the east gable and south transept have been referred to. In the town church the citizens had accommodation that sufficed for their requirements, and the Cathedral, left tenantless, readily fell into disrepair, and on the first breach, and a use found for the cut stone in building operations, its demolition was assured. By Parliamentary grant the Town Council were permitted to employ the materials for the city wall. Only so late as 1650 did the half of the west gable collapse. The monastery fell into private hands; its buildings were put to various uses, altered, and so gradually disappeared. For long a fair was held within its precincts, and later a modern mansion built in its midst. This house has recently been acquired by Lord Bute, who is having excavations made; so far only what has been expected in the way of walls has been laid bare. The oldest carved stones about the Cathedral are some fine Celtic slabs built into the east gable with their edges exposed, under the level of the choir floor; it is only quite recently that they were noticed; the twelfth-century builders are thus shown to have been quite as deficient in respect for ancient work, for such these were to them, as any of their successors. The large slab that once covered the built tomb, supposed to be Archbishop James Beaton's, that lies south of the high altar, has apparently at one time been covered with metal plates, now, of course, gone. Round the walls of the Chapter House vestibule and the sacristy are ranged a number of very interesting carved tombstones of late seventeenth and of eighteenth century date. Of the earliest work the capitals, where they exist at all, are well preserved; of the later work, especially at the west gable, both carved capitals and mouldings generally, being of a softer stone, have very much decayed. About six years ago, under the direction of Mr. David Henry, F.S.A., Scot., the lines of the Cathedral were ascertained by digging, and then marked out on the turf. Mr. Henry has interested himself for years in the building, and from his researches much of the foregoing information has been obtained.

DESIGN FOR A COUNTRY HOUSE.

THESE elevations for a Country House were exhibited at the last Royal Academy exhibition, and are the design of Mr. Gerald C. Horsley.

As it will be seen, the special feature in the design is the introduction of bas-relief subjects on the exterior walls, the subjects in the gables of the entrance front representing music and dancing, those on the elevation to the garden the Four Seasons.

As regards the plan, we hardly think the drawing-room would be found a very comfortable room with the doors opening on each side of the fireplace, any more than would the dining-room in Mr. Blomfield's plan of a house published in our issue of January 13. There is too much tendency to neglect these points in the comfort of house-planning, among some of the architects whose houses are no doubt among the most interesting to look at. As Bacon says, "Houses are built to

live in, not to look at;" and though that is perhaps putting it a little too broadly, it serves to call attention to a side of the matter which seems to be getting overlooked.

ARCHITECTURAL SOCIETIES.

CARLISLE ARCHITECTURAL, ENGINEERING, AND SURVEYING ASSOCIATION.—A meeting of this Association was held on the 24th ult. in the Town-hall, Mr. Higginson occupying the chair. A lecture was given by Mr. C. Lonsdale on "Some Trees and their Uses." Commencing by tracing the growth and formation of a tree from the plantation of the seed until it attained the proportions of a tree suitable to be cut down for the uses for which timber is indispensable, the lecturer proceeded to give a detailed description of the species and botanical divisions of most of the trees grown or in use in this country, with the purposes for which each wood is used. The necessary three samples of each of the woods in general use were shown, together with samples of other woods. The manner in which the balks are cut up to procure the maximum amount of wood, and the general and most useful stock sizes from each tree, and the methods of storage and seasoning necessary to prevent "tainting," were points which the lecturer explained. A vote of thanks was unanimously accorded to Mr. Lonsdale for his lecture.

NORTHERN ARCHITECTURAL ASSOCIATION.—A meeting of the members of the Northern Architectural Association was held in the Art Gallery, Newcastle, on the 24th ult., Mr. Oswald presiding, when Mr. Charles E. Oliver, F.S.I., read a paper on "The Timber Trees of New Zealand." He said that, although it was not likely that New Zealand woods would be commonly used in this country, he thought it was highly probable that some of these woods ere long would be imported here at a price which would win for them a prominent place in our wood markets. New Zealand is so well watered and so well adapted to the growth of timber, that, even when forests are cut down, they soon reproduce themselves; but this was no excuse for the wanton waste which often takes place after trees have been felled for timber purposes. The forests are known to contain upwards of forty distinct varieties of timber trees, more than twenty of which were suitable for architectural work, cabinet-making, and many other purposes. For some years past Kawri has been imported into this country. It appeared to him that if Kawri, the most costly of the New Zealand timbers, could be imported here at a price enabling us to use it freely, he thought the same might be done with many other woods, such as the red pine, black pine, totara, &c. The indigeneous forest of New Zealand is ever green, and the general character of the woods resembles the growths of Tasmania and the Australian Continent. Most of the woods are harder, heavier, and more difficult to work than the European and North American timbers. They vary, however, very much among themselves, and are mostly very durable. The majority of the trees rise to a height of forty or fifty feet before putting out their branches, a detail which ensures the production of a large amount of clean, regular-grained wood of great size. On the motion of Mr. Taylor, seconded by Mr. J. T. Cackett, a vote of thanks was accorded to Mr. Oliver.

GLASGOW SCHOOL OF ART. — The fifth of a series of lectures under the auspices of the Glasgow School of Art, by Mr. William J. Anderson, A.R.I.B.A., was delivered on the 24th ult., in the Corporation Galleries, Glasgow. The special division treated of was "The Culmination of the Renaissance in Rome." This was distinguished from earlier periods partly by the suppression of elements of design foreign to Classical taste, as well as by a greater facility in composition, richness of modelling, and artistic reserve. In the period embraced between the years 1506–1550 all art subsequent to that of Greece culminated. In so far as it was a resurrection of Antique art it was appropriately and naturally consummated in the heart of the ancient world, for Rome at this time had recovered some shadow of its former prosperity, and had become once more in a limited sense the capital of Italy. If it did not wield its empire over Italy as in former days, it became the centre of an influence which had moulded the art and architecture of the civilised world more than any other. Brief sketches of the lives and works of the leading architects of the time were given by the lecturer, and an analysis of the Roman Palazzi followed, with numerous illustrations. The history of St. Peter's Cathedral was considered in detail, plans and projects of various architects being shown on the screen, together with elevations and views of the existing fabric.

THE LONDON COUNTY COUNCIL.

THE usual weekly meeting of the London County Council was held on Tuesday in the County Hall, Spring Gardens, Mr. John Hutton, Chairman, presiding.

Technical Education.—The adjourned report of the Finance Committee was brought up, containing a memorandum from the Technical Education Board in reference to the disposal of the grant made last year for technical education. The Committee recommended:—

"That, subject to an estimate being submitted by the Finance Committee as required by the statute, the Council is of opinion that the sum of 57,000*l.*, to be paid out of the amount receivable by the Council under the Local Taxation (Customs and Excise) Act, 1890, should be appropriated and contributed in respect of the year ending March 31, 1895, for the purposes of technical education, and that it be referred to the Finance Committee to submit to the Council the necessary formal resolution."

Mr. Campbell moved:—"That the recommendation be referred back to the Committee with an instruction to consider whether the suggested grant should be increased to 90,000*l.*"

The amendment, which was seconded by Mr. Crooks, was negatived by a large majority, and the recommendation of the Committee was agreed to.

The Technical Education Board brought up a report which stated that the Board has formulated the conditions under which it will make grants in aid of schools of art and art classes. The Board has had the advantage of the advice of Mr. Ed. R. Taylor, head master of the Municipal School of Art in Birmingham. The main objects which have been borne in mind in framing these conditions have been (1) the grant of substantial encouragement to efficient art teaching in all parts of London; (2) the provision of new and increased teaching apparatus; (3) the abolition of the farming system; (4) the promotion of instruction in the schools of art of some artistic handicraft; (5) the efficient organisation of the classes, and a diminution in the number of students under one teacher; (6) the introduction of blackboard demonstrations when desirable; (7) special attention to design; and (8) the encouragement of classes within the reach of the artisan population. In order to encourage the more systematic study of art, especially by artisan students, the Board has decided to award in June next not more than 100 evening art exhibitions, twenty artisan scholarships, and twenty schools of art scholarships. The scholarships and exhibitions will be awarded after examinations in freehand and geometrical drawing, including design, in accordance with the circular which has been circulated to the Council. The Board has received deputations from the Worshipful Company of Plumbers, and the Technical Education Committee of the National Conference of Painters and Decorators, to urge additional provision for instruction in their crafts. To meet the demand thus expressed, the Board has announced its intention of making grants in aid of evening classes in technology under certain conditions. In offering aid to these classes, which include the subjects on which aid is granted by the City and Guilds of London Institute and any other applications of science or art to industry which the Board may approve, it has been the object of the Board to secure that (1) all practical instruction should be associated with training in drawing, mechanics, mensuration, or such other subjects as may be essential to the proper understanding of the workshop practice; (2) that the teaching of such subjects as plumbing, bricklaying, joinery, &c., should be confined to students who are *bonâ-fide* members of the respective trades; (3) that the number of students under one teacher should not be too large for efficient instruction; (4) that the classes should not be starved for want of material; and (5) that the teachers should be paid mainly by fixed salaries, and in no case by grants on examination results.

Sewer Examinations.—The adjourned report of the Main Drainage Committee contained the following paragraph, the recommendation, after a short discussion, being agreed to:—

"Referring to our report to the Council on January 16* on the result of sewer air investigations carried out by Mr. J. Parry Laws, we have now received a report from the chemist and Mr. Laws stating what further experiments should, in their opinion, be made with the view to obtaining further information with reference to the organisms in sewer air. They consider that, as a precise knowledge of the various micro-organisms occurring in sewage will doubtless considerably strengthen the important conclusion already arrived at that the micro-organisms of sewer air are derived from micro-organisms of fresh air and not from the micro-organisms of sewage, it is most desirable to study the micro-organisms existing in sewage under various conditions with a view to classifying them and determining the relative frequency with which each different species occurs, and they also suggest that as it will be necessary to determine whether some of the organisms isolated from sewage possess pathogenic properties Mr. Laws should be associated with Dr. F. Andrewes in this particular investigation. The inclusive fee for this investigation and report would be 126*l.*, in addition to 30*l.* for apparatus. Having given careful attention to this matter, and having conferred also with the medical officer, we deem it advisable that these investigations should be continued in the manner proposed, and we accordingly recommend—

'That subject to an estimate being submitted to the Council by the Finance Committee as required by the statute, the Committee be authorised to retain the services of Mr. Laws and Dr. Andrewes for the purpose, at a total cost, including apparatus, of 156*l.*'"

Proposed New Pumping Station at Heathwall.—The same Committee reported that they had had under consideration for some time past the necessity of dealing more efficiently with the storm waters entering the southern low-level sewer. The preliminary approximate cost of the proposed new station, including that of the property required, is 18,000*l.* The property consists of land and premises adjoining and at the rear of a house in Nine Elms-lane. The following recommendation of the Committee was agreed to:—

"That the Council do approve of the proposal to erect a new pumping station at Heathwall, and that the solicitor be instructed to take the steps prescribed by Section 153 of the Act 18 and 19 Vict., cap. 120, with the view to an application being made to the Home Secretary for power to acquire the property referred to."

The Purchase of Tramways.—The Highways Committee recommended:—

"That the Council do appeal against the decision of the Queen's Bench Division of the High Court sending back to the arbitrator his award of the amount to be paid by the Council for the undertaking authorised by the London Street Tramways Act, 1870, and that the Highways Committee be authorised to take all necessary measures for the purpose."

This was opposed by Colonel Rotton and others, but the recommendation was carried.

The Fair Wages Question.—The Parks Committee brought up the following recommendation:—

"That the men at present employed at parks and open spaces as lavatory attendants and caretakers, and who are in receipt of wages less than 24*s.* a week, be in future paid at that rate."

Mr. Torrance, the chairman of the committee, declined to formally move the adoption of this recommendation, on the ground that he dissented from it.

Mr. Frank Smith moved its adoption.

A motion to adjourn the matter *sine die* having been lost, after a long discussion, a show of hands was taken on the recommendation of the committee, and resulted in a tie. On a division the recommendation was adopted by fifty-eight votes against thirty-four.

Private Bills Introduced by the Council.—The following Private Bills to be promoted in the coming Session of Parliament were announced by the Parliamentary Committee. London County Council (Improvements), London County Council (Tower Bridge, Southern Approach), London County Council (Water), London County Council (General Powers), and London Streets and Buildings. They came before the Examiner on the 18th ult., and, with the exception of the Water Bill, were declared by him to have complied with the Standing Orders. The Water Bill had been referred to the Water Committee, to consider the course to be adopted when it came before the Standing Orders Committee.

Capacity of Water-closet Flushing Cisterns.—The Public Health and Housing Committee brought up a report in reference to the question of the capacity of water-closet flushing cisterns. After referring to the recent decision of the Council on a previous recommendation*, the report proceeded as follows:—

* See *Builder* for January 20, page 53.

* See *Builder* for December 16, page 451.

"The Council's views were communicated to the Local Government Board, and the Board now points out that the scope of the regulations referred to is limited to the prevention of waste, misuse, undue consumption and contamination of water, and calls attention to the fact that recommendation (*a*), as amended by the Council, cannot be considered as having for its object the prevention of either waste, misuse, or contamination. We agree with the Board in these remarks, and, under the circumstances, have no alternative but to repeat our former recommendation, which was to the effect that the cisterns should be capable of discharging *not more* than three gallons. The Council could, if it thought fit, make a bye-law, under section 39 of the Public Health (London) Act, 1891, prescribing a *minimum* capacity of flushing cisterns, but, as the bye-laws under this Act have so recently come into operation, we do not advise the Council to take this course at present. We propose, however, to consider this point when the by-laws are revised. The Local Government Board suggests that the most convenient method of bringing the question to an issue will be for the Council to make formal application to the water companies under section 19 of the Act of 1871 to make such alterations as the Council may judge to be reasonable and as are warranted by the Act; and that, in the event of the companies' refusal, it will be competent for the Board to proceed in the manner directed in the section. We accordingly recommend:—

'That the Committee be authorised to make formal application to the London water companies for the amendment of their regulations in the particulars specified in the recommendations made by the Committee to the Council in December last . . . .'"

The recommendation was agreed to.

National Exhibitions Building.—The Theatres and Music Halls Committee's report contained the following paragraph, the recommendation being agreed to:—

"We have received from Mr. A. O. Collard, on behalf of Mr. V. A. Applin, certain drawings showing proposed arrangements for the forthcoming exhibition to be held on the site of the National Exhibition Buildings, Earl's Court. The general block plan shows that the whole of the present buildings are to be removed, and a series of new buildings, adapted for various purposes, erected in their place. Full detail drawings of each building will from time to time be submitted for the approval of the Council. We are now in a position to report upon the building which is to be used for spectacular purposes, and which will be fitted with seating accommodation for 5,100 people, and will be provided with a stage and dressing-rooms. The drawings of this theatre have also been considered by the Building Act Committee, who have signified to us their approval of the application, subject to the engineer of the Council being satisfied as to the construction of the building. Certain of the plans of the theatre laid before us on January 10, 1894, have been amended by small flap drawings since received, which provide a fourth exit from the back of the stage and improve the gallery staircases, and are in most respects satisfactory. The three plans which we now submit for approval are the following:—1. Ground plan; lower circle. 2. Second floor plan; boxes and promenade. 3. Third floor plan; upper circle. Further drawings, showing the details of the construction of the galleries, are to be submitted to the Council. Meanwhile, in order that the works may be proceeded with, we recommend—

'That the three plans referred to above presented to the Theatres and Music Halls Committee on January 10, 1894, as amended by the flap drawings presented to the Committee on January 24, 1894, be approved on the following conditions:—

(*a*) That the buildings be constructed to the satisfaction of the Engineer of the Council.

(*b*) That the gallery gangways to the staircase on the east side and the staircase on the west side of the gallery be supported to the satisfaction of the Council.

(*c*) That detail sections of the trusses supporting the seating be furnished to the satisfaction of the Council.'"

Proposed Ground Plan of London.—The following motion, in the name of Mr. Crooks, was on the paper:—"That it be referred to the Corporate Property Committee to consider the expediency of getting together materials for preparing a ground plan of London, showing the various ownerships, and of making a register of London landowners and to report what expenditure they would think necessary and would recommend the Council to incur for the purpose." Some objection was taken to this inquiry, on the ground of its expense, a Councillor stating that it would cost thousands upon thousands to carry it out, and another that the Council had not the legal power to do it. Mr. Crooks explained, however, that it had reference to ground landlords mostly.

The motion was agreed to.

Public Convenience, Westminster Bridge.—The following recommendations of the Bridges Committee were agreed to:—

"(*a*) That the work in connection with the formation of a public convenience at the west end of Westminster Bridge be executed by the Council without the intervention of a contractor, and that the specification and estimate be referred to the Works Committee for that purpose.

(*b*) That the tender of Messrs. B. Finch & Co., amounting to 145*l.* 10s., for the sanitary work in connection with the urinal and lavatories, be accepted.

(*c*) That upon the completion of the work, the convenience be transferred to the Vestry of St. Margaret and St. John, Westminster, upon the terms and conditions mentioned in the Committee's report, and that the terms and conditions be embodied in an agreement to be prepared by the Solicitor."

The Council adjourned at 7 o'clock.

Books.

The Mechanics of Hoisting Machinery. By Dr. JULIUS WEISBACH and PROFESSOR GUSTAV HERRMANN; translated by KARL P. DAHLSTROM. London: Macmillan & Co. 1893.

FOR the production of this practically important treatise in English print we are indebted to Mr. Karl P. Dahlstrom, late Instructor of Mechanical Engineering at the Lehigh University. The second German edition, from which the translation has been made, is recognised by various scientific institutions all over the world as an able text-book for technical schools and a guide for practical engineers, in its dealing with the mechanics of hoisting machinery, including accumulators, excavators, and pile-drivers. In the letterpress, references are made to the English translations of Weisbach's Mechanics. The metric and British measurements are used, the latter being enclosed in brackets. The authors endeavour in every case to deal with the efficiency of a machine. They show that hoisting machines are usually driven by a rotating shaft, because if worked by a lever in the place of gear wheels, its oscillating motion would subject the machine to many inconveniences in hoisting or lowering. They recommend the application of graphical methods for determining the power to be applied and for ascertaining the efficiency of hoists, as simpler than the numerical calculation, particularly when drawings of the machine are at hand. By constructing a diagram sufficiently large, we obtain a degree of accuracy which suffices for every case. The principles of graphical statics to determine the effort required to operate a jack-screw are investigated, and the authors show that owing to their small efficiency, screws should not be employed in hoisting apparatus intended for continuous and heavy service. On the other hand they may be advantageously used for apparatus needed to run intermittently, on account of the security they insure against running down by virtue of their self-locking property. It is interesting to note that in a screw-apparatus in which the nut is turned, a smaller efficiency results than in those machines in which the spindle of the screw is turned. In differential screw-jacks a load can be lifted by imparting rotation to both screw and nut. To hoist heavy loads speedily, windlasses are often used, combined with a small steam-engine where no other source of power is available. Steam hoisting-engines are largely adopted in mines. In Germany the engine cylinders are generally made horizontal, while in England vertical beam-engines, or engines of the inverted type, are largely employed, the latter type with a view to give the drum as high a location as possible, by which arrangement the bend of the hoisting rope around the guide pulleys is reduced to a minimum. Compressed air and electric motors are sometimes introduced. In the former case, the air is compressed by steam or water-power, and afterwards used in a motor, coupled to the hoisting-machine. The losses connected with the use of pneumatic apparatus are due to the fact that for every operation the lifting-cylinder must be filled with air of the required density, which necessitates an expenditure of a corresponding amount of work that is lost. The efficiency of pneumatic hoists decreases as the ratio of densities increases, and the result is more unfavourable in vacuum lifts than when compressed air is employed. In places where the water-mains give sufficient available head or pressure, hydraulic hoists may be conveniently introduced as they do not then need a special prime mover, but since water is practically incompressible it is necessary in all hydraulic hoisting machinery to use special precautions against shocks which occur when masses in motion are suddenly checked. Elevated reservoirs are introduced between the prime source of supply and the lift. They act as accumulators, and their use, as well as the service of relief-valves in a pipe connecting the hoist-cylinder with the valve chamber of the water service, is fully described in the book before us. For machinery which is to work continuously, the accumulator is not an advantageous prime mover on account of its indirect mode of action, but when a large number of hoists are to be worked at once by a single prime mover the indirect system is a convenient and sure way of easily distributing the required energy to considerable distances. Cranes and sheers, excavators and dredgers, pile-driving machines, are fully considered, while a description of hoist employed in making the Suez Canal adds to the interest of a well-illustrated and exceedingly valuable addition to professional literature.

Notes on Cylinder Bridge Piers, and the Well System of Foundations. By JOHN NEWMAN, A.M.Inst.C.E.: London, E. & F. N. Spon. 1893.

REFERENCE to the table of contents and to the index provided to this book shows that most of the chief points requiring attention in the design, sinking, or erection of cylinder piers or wells, either by compressed air, dredging, or open trench work have been dealt with by the author; and upon a perusal of the eighteen chapters which form the volume, we find a good deal of practical information, most of which only exists elsewhere in a scattered form in the transactions of professional and scientific societies, and in various articles of the engineering press. The author has done well to collect this information into one book, and he has taken this opportunity to add numerous hints, alike useful to the resident engineer, bridge builder, contractor, and last, though not least, the student. The iron cylinder system of bridge foundations is not economical if many cylinders have to be sunk close together; the most efficient employment of that method is where one cylinder is sufficient for a single girder of a bridge, and where only two to four cylinders are needed for one pier. The system is frequently adopted for foundations in deep water, and of considerable depth in the ground. Experience leads engineers nowadays to prefer one or two large cylinders to be used instead of many smaller ones, as they can be sunk with much greater certainty, and at a less proportionate cost than several smaller cylinders. Moreover, they are not so liable to get out of the vertical in sinking. In cases where the distance between two cylinders is not greater than the diameter of the cylinder, they have preferably to be sunk alternately, as there is a tendency, when they are being sunk simultaneously to draw towards one another. The well system is economical in sand or silt, and where the water is of moderate depth, and when the depth is too great for the employment of compressed air, provided special plant and excavating apparatus is used. The vacuum principle of sinking cylinders has been generally abandoned in favour of the compressed air method. The main points in sinking by means of compressed air are to supply sufficient air for the expulsion of the water, and for the men in the working chamber, the latter being so designed as to provide for the ready entrance and exit of the workmen, for the introduction of plant and the casing, and for the removal and discharge of the material excavated. The author thinks it is questionable whether the compressed-air method is the best system to employ at depths greater than from 80 ft. to 100 ft. below water-level, and that, except under special circumstances, he would not recommend it for depths less than about 25 ft. below water, but that the depth for its economical adoption, he must admit, is not easy to determine. Excavating and dredging apparatus for removing the earth from the interior of an open well or cylinder are fully investigated. The well system has failed when boulders and obstructions in sinking have been encountered. For loose sand, mud, and silt the well system is particularly adapted; and among the pumps used for pumping sandy water may be named the centrifugal, rotary, pulsometer, and chain pumps. Their use, however, necessitates lifting a large quantity of water with the sand, and thus much of the power applied is wasted, and perhaps a "run" of earth is induced by a flow of water being caused. Experience has shown that where sand pumps are used it is better to work by bands and not by gearing, *i.e.*, by a yielding medium in preference to rigid driving, because in the event of a pump becoming choked less injury results to the machinery by a sudden shock. The author describes the dredging apparatus employed at the harbours of Calais, Dunkirk, and elsewhere. While every case of a separate foundation must

be dealt with independently, there is much to be learnt from the study of Mr. Newman's book relating to the construction of bridge, quay, dock, weir, and river wall foundations.

Theoretical Mechanics. By ALEXANDER ZIWET. Two vols. London: Macmillan & Co. 1893.

THE author of these two volumes, who holds the position of Assistant-Professor of Mathematics in the University of Michigan, has treated the subject of Kinematics in Part I., and of Dynamics and Statics in Part II., in a purely theoretical manner, assuming that his readers have acquired a knowledge of the elements of higher mathematics, it being the custom in many American colleges to reserve the practical study of mechanical science until considerable advance in mathematical knowledge has been attained. In this country, the study of mechanics is taken up at an earlier stage of the student's course. To the advanced student, the work of Professor Ziwet will be especially welcome. Theoretical knowledge is essential to successful practice. There are some excellent examples at the end of each chapter which a mathematician will rejoice in working out, and answers are supplied at the end of each volume. It is the experience of every student that a subject which is not perfectly clear when studied from the writings of one authority may become intelligible, and, consequently, the property of the mind when the data, furnished by another authority, are perused. We are glad to note that prominence is given to geometrical methods and graphical constructions wherever possible, because such methods seem to conform best to the nature of the subject. The applications given here and there, are to be regarded merely as illustrations of the general principles enunciated. The fundamental laws of dynamics can, of course, only be fully understood by studying kinetics, and the consideration of this branch is promised as Part III., to be ready towards the end of the present year.—The three parts will form a valuable proof of the utility and importance of purely mathematical training to practical application of science.

Injectors: their Theory, Construction, and Working. By W. PULLEN, Wh.Sc., A.M.Inst.C.E. Manchester: Technical Publishing Company. 1893.

WE are pleased to welcome this little volume, as there is a paucity of books dealing exclusively with the subject of injectors, and the value of the present treatise is enhanced by the fact that the author's diagrams are not mere sketches, but are selections copied from drawings which accompany patent specifications, in addition to those supplied to him by manufacturers. Prior to the invention of M. Giffard, a French engineer, who took out a patent in 1858 for an injector, such high-pressure boilers as then existed, as well as low-pressure boilers had to be supplied with water by pumps; but upon M. Giffard's bringing out a means of forcing water into a boiler by the motion imparted from the high velocity of a jet of steam impinging upon the water at rest, the invention was speedily introduced into England by Messrs. Sharpe, Stewart, & Co.; and in tracing its development in this country, the author adds to the value of the theory of the working of an injector, which he fully discusses, by furnishing diagrams showing the construction of various standard injectors, among which we have illustrated those in use upon the London and North-Western and Great Western Railways. The author gives an honest account of various applications of the injector, free from the eulogistic paragraphs often found in sale catalogues, and he calls special attention to the importance of rendering the live steam entirely automatic and independent of the driver or fireman, so as to ensure automaticity in restarting. An interesting historical notice concludes the volume.

Concrete: its Nature and Uses. By GEORGE L. SUTCLIFFE, A.R.I.B.A. London: Crosby Lockwood & Son. 1893.

OUR readers are already familiar with the main portion of the text in this useful little volume, but numerous additions are introduced into the book in its present form. The original appeared as our "Student's Column" during the latter half of the year 1892, and, coupled with the extra information contained in the bound volume before us, which the space allotted weekly to our "Student's Column" articles did not admit of our publishing during this limited period of six months, we have now the advantage of continuity of matter and of a copious index. The component parts of concrete are carefully classified, and their treatment in the formation of concrete ably dealt with. The application of concrete to foundations, walls, floor beams, floor surfaces, roofs, and stairs is thoroughly investigated, and the author deserves credit for quoting his authorities. The work is stated to be "a book for architects, builders, contractors, and clerks of works," but we have no hesitation in adding that many civil engineers will also derive profit from its perusal. The results of experiments are skilfully tabulated, and the letterpress is well illustrated.

Correspondence.

To the Editor of THE BUILDER.

PRIME COST.

SIR,—For a "Builder's Manager," who must be acquainted to some extent with the making up of accounts for works carried out under the almost general way—viz., of a lump sum contract, with a priced out bill of quantities deposited as a schedule, for the purpose of adjusting variations—to suggest in your issue for the 20th ult. the "knocking something off the main total," or "putting the fixing at a low rate," cannot possibly tend to induce those who have the arranging of contracts to quote list prices instead of giving P.C. amounts.

In the first place, how can a bill of quantities priced out in the way he suggests form an accurate schedule? Surely he would not propose the extremely inconvenient way of taking off a percentage throughout the whole of the bill, to equal this "knocked-off lump sum," and why, indeed, should the "fixing" be put down at a lower figure than it ought to be to set against some trade or other discounts?

If articles can be selected from manufacturers' lists there can be no necessity, either for giving the list prices or the P.C. amounts. As a rule, when P.C. amounts occur in bills of quantities, they are to cover some special work or goods that most probably the architect has not finally decided upon, or even as to which firm of manufacturers he will go to for them. List prices cannot possibly be given in cases of this sort.

It must be apparent that a builder pricing out a bill of quantities can include any percentage he likes for profit on these P.C.s, just as well as if he had a figure given which included for some—perhaps uncertain—amount of discount, and did it in one of the more roundabout ways suggested by a "Builder's Manager."

The parallel tried to be obtained between dealings in groceries, drapery, &c., does not commend itself as being very applicable, as in the former case the buyer and seller come in direct contact, and it is open to the former to purchase or go elsewhere, whilst in building matters it is certainly inconvenient, and sometimes impracticable to go elsewhere, which would mean having men at work upon a contract not under one control.

For a "Builder's Manager" to talk about a quantity surveyor receiving 2*l.* 10s. for the mere writing of a couple of lines to stipulate that 100*l.* is to be provided for a certain piece of work, shows pretty clearly that he has but feeble knowledge of a surveyor's duties. When a surveyor has to write letters, interview specialists, and sometimes do a host of other things to arrive at a proper amount to provide, he is not quite so well paid as your correspondent would like to make out.

H. RILEY.

MONTPELLIER BATHS, HARROGATE.

SIR,—In last week's issue of the *Builder* you refer to the list of tenders sent by me for the above buildings, and, as you have given your view of the matter, perhaps you will allow me to give mine.

You say you were "surprised to see my name attached to the list instead of the architects," and concluded that the Borough Surveyor had prepared the quantities.

Am I to infer that you know so little of what is in your own paper that you did not know who had prepared the quantities? A long advertisement was inserted in the *Builder*, along with the other technical papers, three consecutive weeks—viz., November 25, December 2, and December 9, setting forth in full the names and addresses of the architects as well as the quantity surveyors, and this advertisement was signed by myself (on behalf of the Corporation), stating that the plans, &c., could be seen, and quantities obtained, at my office, and yet "you concluded that the Borough Surveyor had prepared the quantities."

The reason my name was coupled with the list of accepted tenders was briefly this. As soon as the Council accepted the tenders I prepared a *lithographed circular* giving the names of the successful contractors, and this was sent to each of the parties tendering, with a note stating that the guinea deposit was returned at the same time.

Now, it was a copy of this circular with the amounts of the tenders inserted, and the foot-note crossed out *in red ink* (to save time), which was sent to the *Builder* as well as the other technical papers.

I enclose another copy of the lithographed circular, which was sent to you at the time, in order that you may see how utterly uncalled for was your insulting paragraph ending "with apparently due care that his own name should appear prominently in connexion with the work."

Your readers will understand, when I state that in connexion with these quantities I have written not far short of 1,000 letters and circulars, how naturally anxious I was to economise time, and this it was which led to the circular being sent as described, with the names of the architects and quantity surveyors omitted, for which omission no one is more sorry than SAMUEL STEAD,
Borough Surveyor.

*** Mr. Baggallay, one of the architects to the new baths, has already written to us to say that he thinks we have done Mr. Stead an injustice. On the other hand we received a very decidedly-expressed letter, from a person who from his position ought to have been well-informed, complaining that the Borough Surveyor was putting himself forward in every possible way in the matter, pointing to the position of his name on the list of tenders as an example of it, and calling upon us to oppose this self-assertion on the part of Surveyors. There may, we fear, have been some motive in this letter which did not appear on the surface, but the fact remains that tender lists are invariably headed in our columns with the architect's name, sometimes that of the quantity surveyor being added, and that this tender was sent with the name of the Borough Surveyor only, who was neither. Mr. Stead's remarks about ourselves are ridiculous, and merely show that he is utterly at sea as to the conditions under which a paper is carried on. Does he really imagine that the responsible editor of a paper sees *personally* all the "copy" for such things as tenders and news paragraphs? and is he really not aware that the advertisements in a large journal are entirely under the management of the publisher, and that it is no part of the editor's duty to see them at all? If we have done Mr. Stead injustice as to his intentions we are sorry for it, but he admits that he sent the tender up to us in an improper form. He should have sent it up in the proper form, and there would then have been no misunderstanding.—ED.

NONSUCH PALACE.

SIR,—In a cottage on the road from Ewell to Epsom, there is an old carved doorway built into an inner wall. A man who inhabited the place told me that it came from Nonsuch, and that there were many similar specimens in the houses and cottages in that neighbourhood.

If this local tradition be true, the old palace may not be so hopelessly lost as "H. W. B." thinks.

Is it not also seen in the background of some of the pictures at Hampton Court Palace? D. W.

TRADE MARKS IN GREECE.

SIR,—According to advices just received from Athens, I learn that the Greek Government has decided to permit British subjects to enjoy the legal privileges for the protection of trade marks in accordance with "the most favoured nation," clause in Art. 10 of the Treaty between Great Britain and Greece. The new law requires that proof of British registration shall be produced when seeking registration in Greece. Various other formalities must be carried out, particulars of which I shall be happy to supply to any interested parties.

REGINALD W. BARKER, F.I.Inst., F.S.P.A.
British Trade Protection Office,
Monument Chambers, London, E.C.

HOT-WATER HEATING.

SIR,—Mr. R. J. Macbeth's letter in your last issue contains a good suggestion; much difference of opinion exists in the Midlands respecting high and low pressure hot water heating. In the United States steam is the popular system. I am at present in favour of low-pressure; it is simple, safe, durable, and effective; if a good boiler is used with a rapid circulation, and enough piping or radiating surface, it is perfect, and it requires no attention worth mentioning.

But if anyone can show me that high pressure is the best, I am desirous of listening to him; and, like Mr. R. J. Macbeth, would be very glad to have the matter discussed.

With a boiler that will make the water hot, plenty of radiating surface (either pipes, coils, or radiators), and especially under windows to prevent down draft; rapid circulation, which experience shows how to obtain; plenty of air-taps (which are better than open-air pipes); then low pressure is the best, although its action may be, at starting the fire, slower than high pressure. A. P. JEVON.

Erdington.

"STAINED GLASS AND DESIGNING."—In reference to the recent correspondence on this subject Mr. Medland Taylor writes again that he did not say, and could not have said, that the architect who had criticised and revised a design had a claim to be considered the designer, as he never thought so. That was however the impression left on our mind by a former letter from him to us, and as neither of us has a copy of the letter, it remains a question between his memory and ours.

The Student's Column.

THE STRUCTURE AND PHYSICAL PROPERTIES OF BUILDING STONES.—V.

SPECIFIC GRAVITY.

THE terms 'specific gravity' and 'density' are used by many as though they were synonymous in meaning; but this is not the case. If we conceive a portion of matter to be divided into any number of parts having equal volumes, then if the masses of these parts are equal, in whatever way the division be conceived as taking place, that body is one of uniform density.* The density of such a body is the mass of the unit of volume. If now we take the density of distilled water at 4° C. to be unity, the relative density of any other substance is the ratio which the mass of any given volume of that substance, at that temperature, bears to the mass of an equal volume of water. The *relative density* of a substance is called its *specific gravity*.

To calculate the specific gravity of a body it is sufficient to determine its weight and that of an equal volume of water, and then to divide the first weight by the second. The methods of determining this are very numerous, but we need only refer to those adopted in estimating the relative density of building stones.

(*a*) In one method the observers have experimented with cut and ground cubes of stone, each of which was carefully measured so that its cubical contents could be calculated. Its weight was then ascertained, and compared with the known weight of an equal volume of water at the standard temperature, as above alluded to.

(*b*) In another method, the specimens dealt with were roughly-cut samples of stone, approximately cubical. Having been allowed to dry indoors, they were then weighed and subsequently immersed in water for some hours, so that they might absorb as much as possible. They were then weighed in water, suspended by a thread from the analytical balance used. The weight in air was divided by the loss of weight in water, and the result taken as the specific gravity.

(*c*) In a third method, the samples operated upon were dried at a constant temperature, weighed, and then immersed in cold water, distilled, and freed from air by boiling. The vessel containing the specimens was placed in the receiver of an air-pump, and a partial exhaustion of the air of the receiver allowed the water to completely saturate the stones. They were then weighed in water, and the specific gravity computed in the usual manner.

(*d*) In a fourth method, the relative density of the particles composing the stone has been ascertained either by (1) crushing the specimens to powder and obtaining the result by means of the "specific gravity bottle"; or (2) by assuming that the water absorbed during immersion when the atmospheric pressure is removed completely replaces the air which previously occupied the pores.

We have given the foregoing particulars as to methods adopted in determining the specific gravity of building stones, in order that the reader may fully comprehend the manner in which an exceedingly simple principle in physics has been variously interpreted; and also to account in some measure for divergent published results of the specific gravity of one and the same material. The question is full of interest to the architect, as we shall presently attempt to show. We have before us copies of two reports drawn up respectively by two well-known analytical chemists, in each of which the specific gravity of a particular stone is quoted, but with very different results. In one it is stated to be 2·22, whilst in the other we learn that it is 2·45. In an official report on the same stone its specific gravity is quoted as 2·26 and 2·64. And the case we have chosen for illustration is by no means an isolated example. The range in regard to the specific gravity of any well-known building stone is equally as wide, and wider in most instances. Well may the lay reader regard the whole subject with feelings akin to disgust. We were about to say that the majority of the published results of relative densities are of no use whatever, until we remembered that they do, to some extent, serve the ends of a certain class of stone agents who rejoice in quoting the lowest results on their opponents' stones, and the highest in regard to their own, and *vice versâ* where light stone is required.

The cause of the widely-divergent results is not difficult to understand on a careful consideration of the methods, already detailed, by which the specific gravities of building stones have been ascertained. We have seen that in some instances the results were calculated on comparing (1) the dry weight with that of an equivalent volume of water, and (2) the dry weight with that of a saturated sample in water. In the first, the amount of water absorbed by the sample is not taken into account, whilst in the second it is. Clearly either one or other of these methods is wrong. Which is right? We do not hesitate to say that the first-mentioned is the accurate one, for, as we have seen, an elementary principle in physics lays down the law that the relative density of a body is its weight compared with the weight of the volume of water displaced by that body during immersion. If, therefore, the body is allowed to absorb water during immersion the results must perforce be inaccurate.

We admit that it is not easy to prevent porous stones from taking up water during an immersion experiment; the method commonly adopted by the physicist is to varnish them, by which process they are rendered practically impervious without altering their volume. Another way is to have the samples cut in cubes, as previously described (method *a*), which is unquestionably the best means of arriving at the result when the cubes are really perfect so that their cubical contents can be accurately calculated; but when the contents have to be estimated, by reason of the cubes not being quite regular (which is most frequently the case) an uncertain element is immediately introduced.

The method adopted in our experiments differs from any of the preceding, and may be briefly described as follows:—All the samples were squarely cut 1½ in. × 1 in. × ½ in., as nearly as may be. Before being weighed in a chemists' balance they were placed in a room for some weeks to get rid of quarry water. They were then placed in shallow pans and immersed in water in the same manner as in the absorption tests detailed in our last article, and allowed to stand therein for one week, or until fully saturated. On being taken out of the water each sample was suspended by thin cotton thread from one of the scales of the balance, submerged in water, and reweighed. The weight of the dry sample was divided by the difference between it and the weight when immersed. Now, the product thus obtained is not the specific gravity of the stone; it is to all intents and purposes the relative density of the particles composing it, which is a different thing. Practically the same result may be obtained by pulverising the material and using the specific gravity bottle. In arriving at the true specific gravity of the stone we have deducted the amount of water absorbed, from the weight of the sample in water, and the difference between the product and the dry weight was used for dividing the latter, the result being the specific gravity. Thus, supposing 412 grains = weight in air of a Coombe Down Bath stone; 254 grains = its weight (after absorption) in water; and 37 grains the amount of water it absorbed. Then 254 − 37 = 217 grains. 412 − 217 = 195 grains. 412 ÷ 195 = 2·11 specific gravity.

From the above it will be gleaned that it is our intention to give two results on each stone, viz.:—(1) Its specific gravity as a whole; and (2) the specific gravity of its component parts as deduced from the absorption experiments.

What practical value has the specific gravity of building stone to an architect? It has been taken as indicative of the relative strength of the material; but this cannot for one moment be admitted, although there is a slight approximation in regard to certain varieties of limestone. We hope to say something further respecting this when dealing with the experiments on strength. Professors Daniell and Wheatstone in their report to the Commissioners on stone for building the Houses of Parliament (1839) stated (p. 36) that "the specimen which has the greatest specific gravity possesses the greatest cohesive strength, absorbs the least quantity of water, and disintegrates the least by the process which imitates the effects of weather"—all of which we beg to question in the light of more recent researches.

The principal value of the specific gravity experiments to architects is to enable them to calculate the weight of stone to be put into their buildings. The weight as given at the quarry is usually incorrect, for many reasons, commercial and otherwise, though blame is not always to be attached to the quarry-owners, on this head. To arrive at the weight of a cubic foot of stone, it is only necessary to multiply its specific gravity by 62·42 lbs.—the weight of a cubic foot of water. Thus, taking the specific gravity of the Bath stone alluded to, 2·11 × 62·42 = 131·7 lbs., the weight of a cubic foot of the stone.

We have seen that some observers have computed specific gravity from specimens saturated with water. If we had adopted that method (which is based on an erroneous conception of specific gravity), the following would have resulted from the same sample of Bath stone referred to. Its specific gravity, instead of being 2·11, would be 2·61. Therefore, 2·61 × 62·42 = 162·9 lbs. weight per cubic foot. The difference in the relative weights would be 162·9—131·7 = 31·2 lbs. An architect basing his calculations of weight of structure on this erroneous method would obtain a correspondingly bad result.

On the other hand, we must remember that the weight calculated from the true specific gravity is the dry weight only of the stone; and we know that in practice a building stone is hardly ever dry. In the Bath stone referred to, then, 131·7 lbs. per cubic foot is the minimum weight. This particular sample absorbed 9·09 per cent. of its dry weight of water during the absorption experiments. If we desire to know the maximum weight of the stone we must therefore add this amount, which in round numbers is 12 lbs. to the minimum weight—131·7 + 12 = 143·7 lbs. But we have remarked that when built up, a stone never absorbs its full complement of moisture. When in the structure it would weigh about 137 lbs. per cubic foot, though this would naturally vary in dry and wet seasons.

In marine works, the greater the relative density of the stone used, other things being equal, the more suitable it is for the purpose.

Specific gravity is sometimes quoted in connexion with road metal, as an index of its quality; we cannot discuss this point now, suffice it to say it is of no use whatever in that respect.

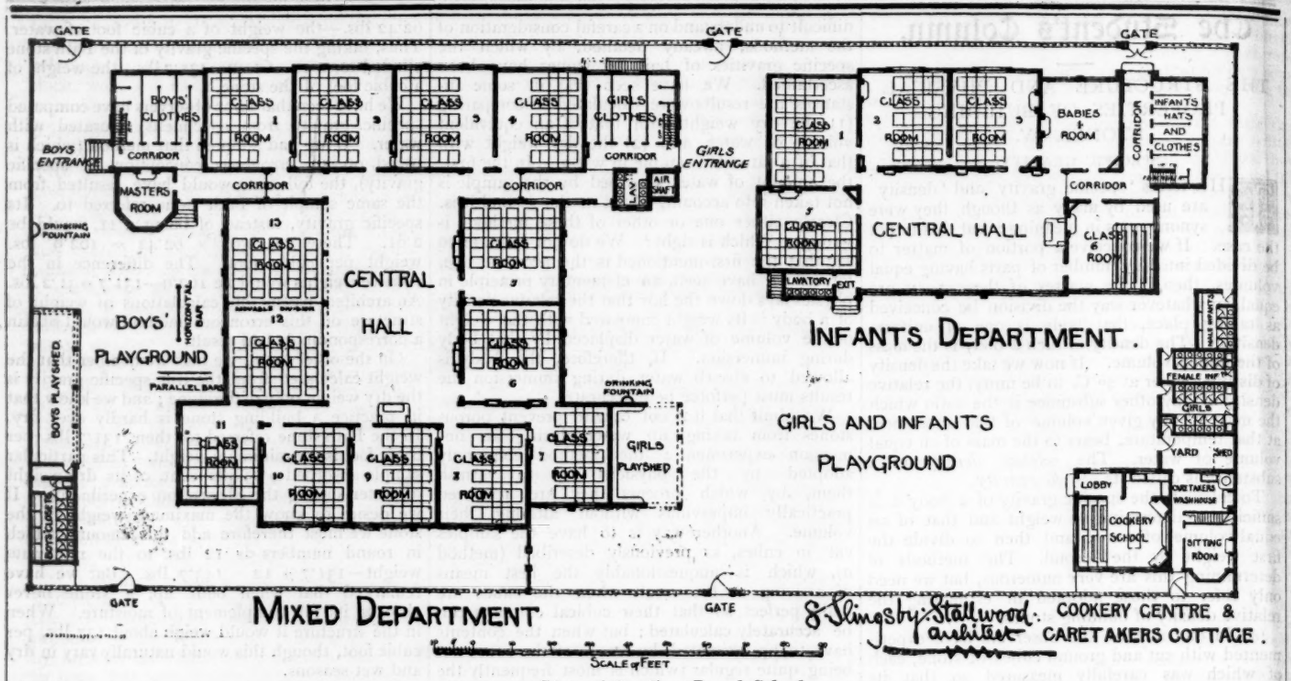
* Ganot's "Physics" 9th ed. (1879), p. 11.

OBITUARY.

MR. HENRY BOWES SCOTT.—We have learnt with regret of the decease of Mr. Henry Bowes Scott, widely known as a partner in the firms of Bowes Scott & Read and Bowes Scott and Western. He was a son of the late Major-General Scott, C.B., R.E., F.R.S., the well-known designer of the Royal Albert Hall, and devoted his life to engineering pursuits. He was not only well-known as an authority in sanitary engineering, but was practically one of the first pioneers of electric lighting, although he subsequently became mainly identified with mechanical engineering. Mr. Bowes Scott was to a great extent instrumental in introducing Rogers Field's Automatic Syphon to public notice, by means of which the health of the larger centres of population was much improved, and his genial and popular presence will be widely missed in engineering circles. He married in 1879 a daughter of the late Colonel Sir Hugh Owen, Bart., A.D.C. to the Queen, and leaves a son and two daughters.

GENERAL BUILDING NEWS.

HIGHER GRADE SCHOOL, WOLVERHAMPTON.—On the 16th ult. Professor Jebb, M.P., opened a new higher grade school, situated on the New Hampton-road, Wolverhampton. The main front faces the New Hampton-road, being two stories high, and is designed in the Renaissance style; the façade is broken up by gables. The materials used are red-pressed bricks and terra-cotta, with green slates for the roof, the boys', or main entrance, being placed between the main block and the wing devoted to a technical department. The return elevation on the east side is carried out to harmonise with the main front, and faces the new street now in course of construction. Accommodation is provided for 372 boys and 252 girls. This is exclusive of the cookery and technical department. The boys are placed on the ground floor, the plan consisting of large central hall, surrounded by six class-rooms opening direct out of the same. The size of this hall is 67 ft. by 34 ft., and 29 ft. high to the tie-beam and 44 ft. to the ridge, the roof being open timbered. It has a gallery 5 ft. 6 in. wide all round at first floor level. To the left of the boys' entrance is the technical wing, consisting of lecture theatre, with preparation room, &c., in connexion. The remaining space on the ground floor is taken up with head-master's room, assistant teachers' room, hat and cloak rooms, lavatory, book stores, staircases, and lifts. The girls are placed on the first floor, the class-rooms coming over those on the ground floor and opening on to the gallery round the central hall. The cookery room with scullery and stores are at the rear of the building. The chemical laboratory is placed in the wing over the lecture theatre and preparation room; adjoining this is the physical laboratory and art room. The remaining space is devoted to head-mistress's room, assistant teachers' room, cloak rooms, lavatory, book stores, staircases, and lifts. The boys enter from the New Hampton-road, and



Plan of Reading Board Schools.

the girls from the new street on the east side. Two stone staircases are provided, one to each entrance, that to the boys' entrance being available for the technical section. Open and covered asphalted playgrounds are provided; in the boys' playground are two workshops, each 25 ft. by 16 ft. The building is warmed throughout with hot water on the low pressure system, with radiators, carried out by Mr. J. Attwood, of Stourbridge, besides which all the rooms have open fireplaces. Internally the walls are finished to a height of 4 ft. with a painted wood dado, above which they are plastered and coloured. The wrought-iron gates and railings were supplied by Brawn & Co., of Birmingham; the terra-cotta by Dennis, of Ruabon; the wrought-iron gas-fittings by Winfield, Limited, of Birmingham. The general contract for the erection of these schools was placed in the hands of Mr. H. Lovatt, of Wolverhampton. The cost has been about 12,000*l.* The whole of the work has been designed and carried out under the personal supervision of the Architect to the Board, Mr. Thomas Fleeming, of Wolverhampton.

DEAF AND DUMB INSTITUTE, GLASGOW.—A new Deaf and Dumb Institute for Glasgow is being erected at the corner of West Renfield-street and West Campbell-street. The new institute, of which Mr. Robert Duncan, of Glasgow, is the architect, is estimated to cost 6,000*l.* Polished red freestone is being used, and the style of architecture is Italian. The structure is three stories in height. There are four flats, one being below the street level. Two work and reception rooms, kitchen, and heating-chamber occupy the basement, and on the street floor is a large central hall, to which access is had from the main entrance in West Regent-street. Leading off this hall are the office of the secretary, reception-room, large reading-room, library, billiard-room, a gymnasium, chess and bath room. The second floor, reached by the main staircase from the entrance vestibule, is entirely occupied by a hall, which accommodates some 500 people. Attics complete the building, and sleeping rooms are to be provided here for casual visitors in quest of employment.

ALTERATIONS, FALKIRK POORHOUSE, STIRLINGSHIRE.—On the 29th ult. Falkirk Poorhouse was re-opened after alterations and improvements. The work has been carried out from plans prepared by Messrs. A. & W. Black, architects, Falkirk, and embraces the following additions and improvements:—The erection of a boys' day-room, 20 ft. by 28½ ft.; the addition of a corridor along the whole length of the back of the building, giving access to all parts; and the erection of bath-room and lavatory accommodation in direct communication with all the wards in the three flats of the building. The flooring throughout the house has also been re-laid, and all the walls of the various wards repainted. The detached building which was formerly used as an asylum in connexion with the house has been converted into wash-houses, laundry, and workshops, while in connexion with the porter's lodge at the entrance gate a bath-room has been erected having communication with the probationary wards.

MASONIC BUILDINGS, PONTEFRACT.—A few days since the foundation-stone was laid of new Masonic buildings which are being erected in Ropergate, Pontefract. The buildings will be of red brick, with terra-cotta panelling and stone facings. There will be a caretaker's house adjoining, the whole work costing 1,000*l.*, apart from the price of the site. Mr. J. H. Greaves, is the architect.

BOARD SCHOOLS, READING, BERKS.—The new Board Schools recently erected for the Reading Board and to be known as "Battle" Schools have just been opened. They have class-room accommodation for 1,136 children, with a cookery centre and caretaker's residence. The buildings are all of one story in three separate detached blocks. The main block is the mixed school for 768 boys and girls. The second block is for 364 infants, and the remaining block consists of the cookery school and caretaker's house combined. The arrangements of plan are on the class-room system with central halls, the mixed-school having thirteen class-rooms and the infants' school six. The buildings are faced externally with Higgs & Sons' hand-made red bricks with strings and other features carried out in special moulded brick. A feature in the centre of the group is a campanile which serves as a ventilating shaft communicating with underground passages and culverts through which the vitiated air is drawn from the several rooms and halls by means of a propeller worked by a gas-engine, and a constant circulation of fresh air is thus secured. The heating is by means of hot-water ventilating radiators and coils. All the windows are fitted with Leggott's gear for summer ventilation; the floors are of pitch pine blocks laid by "The Wood Block Flooring Company." The whole of the play-grounds are paved with "Granitic" paving throughout. The builders are Messrs. Higgs & Sons of Reading; the hot-water heating is by Mr. E. Oldroyd of Leeds; the wrought-iron fencing (of which there is a considerable quantity) is by Messrs. Hill & Smith of Brierley Hill; Mr. R. Pratt was clerk of works, and the architect is Mr. S. Slingsby-Stallwood, F.S.A., of Reading.

SCHOOL BUILDINGS, ST. STEPHEN'S-IN-BRANWELL.—A new school has just been completed at Whitemoor for St. Stephen's-in-Branwell School Board, Cornwall. Accommodation in the school includes a main room 50 ft. by 18 ft., class-room 18 ft. by 16 ft., and infants' 36 ft. by 16 ft., and is for about 200 children. Lobbies having entrances therefrom to each room and cloak-rooms are included, the latter being fitted with lavatory basins. All the school and class-room floors are laid with wood blocks, the cloak-rooms and lobbies with tiles. The plans were prepared and the work superintended by Mr. Hill, architect, Redruth, and the contract was let to Mr. Watters, of St. Stephen's, for the carpentry, and Mr. Gilbert, of Trelion, for masonry.

BOARD SCHOOLS, LONGPORT, STAFFORDSHIRE. New Board Schools have just been opened at Longport. The premises form an extension to the building which has been for some years used as an infants' school. The architect is Mr. A. R. Wood, of Tunstall. The materials employed are principally red brick with terra-cotta embellishments. The contractor for the building was Mr. W. Grant, of Burslem, whose tender was 4,520*l.* The Sneyd Colliery Company supplied the glazed bricks used in the decoration of the interior, Messrs. Trusswell & Son the heating apparatus, and Mr. Eardley has executed the plumbing and glazing.

BOARD SCHOOL, OLDHAM.—A new Board School was opened on the 27th ult. at Oldham. The school consists of two separate blocks of buildings one story high—an infant department and a mixed department—the former building being placed at the north-west end of the site, and the latter at the opposite end. Separate playgrounds are obtained for boys, and for girls and infants, with entrances from both Coppice-street and Fern-street. The total accommodation is for 1,010 children. The infant school consists of a central hall, 36 ft. by 50 ft., accommodating 90 children, with five class-rooms arranged on two sides, each room providing for 60 children, the total number of infants provided for being 390. A marching corridor, with lavatory and cloakroom, and teachers' rooms placed on one side, gives access to the central hall. The mixed school contains a central hall, 46 ft. 9 in. wide by 80 ft. long, lighted by a continuous lantern and by dormer windows, and accommodates a class of sixty children. Nine class-rooms are grouped around the hall, with direct access therefrom. Two of these rooms accommodate seventy scholars each, and seven provide for sixty each, being a total accommodation for 620 mixed scholars. Provision is made for extension by two class-rooms accommodating eighty scholars each. A gymnasium, 45 ft. by 26 ft. 9 in., is arranged between the corridors, giving separate access thereto for each sex. A cookery room, 37 ft. 4 in. by 22 ft. 6 in., with scullery, is provided, also with access from the girls' corridor. Advantage has been taken of the fall in the level of the site to obtain in a semi-basement a manual instruction room for the boys and a similar room for the teaching of laundry work to the girls. Rooms for the principal and assistant teachers are obtained on either side of and over the entrances. A tower surmounts the boys' entrance. A caretaker's residence is also provided in a separate building at the north-west end of the site. The buildings are built of Messrs. Platt's bricks with Yorkshire stone dressings. The roofs are covered with slates, and the whole of the floors of the halls and class-rooms are formed with wood blocks on concrete. The entrances and cloak rooms are paved with flags, and the internal walls of the halls and class-rooms are finished with pitch pine dadoes and plastered walls. The internal walls of the entrances, gymnasium, &c., have glazed brick dadoes. The playgrounds are paved with asphalte, and the site is surrounded by walls and wrought iron railings. The general contractor is Mr. Emanuel Whittaker, of Oldham. Mr. W. F. Spencer, of Crossbank Works, Oldham, has executed the hot-water heating; Messrs. Potts & Co., of Leeds, have supplied the clock; the clerk of works is Mr. W. R. Norris, and the architect is Mr. G. E. T. Laurence, of London. The school has cost 15,000*l.*

SANITARY AND ENGINEERING NEWS.

ELECTRIC LIGHT AT THE LONDON SCHOOL BOARD OFFICES.—The plant for this light, which is in the basement of the new buildings, consists of two Babcock-Wilcox water-tube boilers, designed to work at a pressure of 150 lbs. per square inch, which supply steam to a pair of Parson's steam turbines and dynamos of the radial flow type, each capable of supplying 32,000 watts. Arrangements are provided whereby, after the steam has done its work in the engines, it is utilised for heating the hot-water service throughout the building, and also for warming the building itself. This is effected in the following manner:—From the engines the exhaust-pipe is led to three feed water heaters, arranged parallel, and each fitted with valve and by-pass so that the amount of steam passing through each or all of them

can be regulated. One of these heaters is employed to heat the feed-water for the boilers, the other two being in connexion with the hot-water service for the lavatories, &c. After passing through the heaters, the exhaust steam is conveyed along a pipe which is connected with the radiators throughout the building, and also with an exhaust pipe that is carried to the top of the edifice. An automatic back pressure valve is so arranged that when the heating of the building is desired a constant back-pressure that can be adjusted from 0 up to 10 lbs. is maintained on the engines and on the radiator service, the remaining steam, if any, passing the valve and escaping into the air. In order to provide for the heating of the building and of the water-service at such times as the engines are not running, there is further a connexion with a steam-reducing valve which automatically admits live steam from the boilers into the exhaust pipe between the engines and the heaters when the supply of steam to the engines is shut off. When the radiators are in action the greater portion of the steam used for the engines is condensed in the radiators and returned to a receiver, from which it is pumped into the boilers again. As the engines are not internally lubricated, there is no oil or grease in the exhaust steam to cause trouble in the boilers. In this manner both the lighting and the heating of the building are economically effected. In addition to the engine and boiler spaces there is an accumulator room in which there is a battery of storage cells for supplying light at such times as it is not convenient to run the engines. Now that public electric supply companies exist practically all over London, it is often assumed that it is necessarily more economical to obtain electricity from such a supply rather than manufacture it on the premises for any particular building. This is no doubt true in the case of all small installations, but where, as at the School Board Offices, there are upwards of 1,000 lights, and where, in addition, the exhaust steam from the engines can be utilised for heating, which would in any case require boilers and attendance, a private plant is frequently the most economical arrangement.

THE RECONSTRUCTION OF THE NORTH BRIDGE, EDINBURGH.—At a meeting of a sub-committee of the Lord Provost's Committee of the Edinburgh Town Council on the 25th ult., new plans were submitted on behalf of the North British Railway Company for the reconstruction of the North Bridge. Mr. Hall Blyth, C.E., attended the meeting in the interests of the Railway Company, and Sir William Arrol and Mr. Hunter, the law agent of the city, were present to advise the Corporation. The plans submitted showed a design for a hotel at the south-east end of Princes-street, extending backwards to the new buildings, as far as the tramway company's offices, and clearing away the premises of Messrs. Cranston & Elliot and the adjoining buildings on the North Bridge. The proposed new bridge covers the railway area in two spans, with a third and shorter span carrying it over Jeffrey-street, while the railway lines between the North Bridge and the Waverley Bridge are covered with glass. In the course of conversation it transpired that while the railway company were still willing to contribute 30,000*l.* towards the construction of the bridge, Sir William Arrol estimated the total cost of the undertaking at 90,000*l.* It was suggested that although the railway company did not seem willing to pay a sum based on the proportional cost of the bridge, it might be arranged that the company should undertake the building of the bridge, and that the city should limit their contribution to 60,000*l.* The question of widening the North Bridge was afterwards considered, along with estimates of the cost by Messrs. Cousin & Ormiston, architects, and Mr. Laing, City Assessor.

STAINED GLASS AND DECORATION.

ECCLESIASTICAL PAINTING, CAMBRIDGE.—One of the largest ecclesiastical paintings in England has just been completed in the new church of the English Martyrs at Cambridge. It occupies the whole of the space over the eastern arch of the tower, about 23 ft. by 20 ft., and contains about a hundred figures and portions of figures, the largest being about 10 ft. high. The subject is the glorification of the "English Martyrs" (according to the Romish calendar, apparently), and the composition is divided into three *quasi* tiers. The upper tier contains a host of angels with the instruments of the Passion and Music. In the centre below is a large figure of Our Lord, and on either side are the Virgin, St. John the Baptist, and the twelve Apostles. In the lowest tier there are large figures of St. Thomas of Canterbury, and St. Alban, with smaller ones of other canonised martyrs. The whole is painted in petroleum medium, which has a much better effect than oil-painting, and does not discolour like the wax media. The work was composed and painted by Mr. N. H. J. Westlake, F.S.A.

FOREIGN AND COLONIAL.

FRANCE.—MM. Thiebaut, *frères*, have just completed the casting in bronze of an allegorical figure, "La Ceramique," the work of M. Guillaume, which is intended for the decoration of the national manufactory of Sèvres.——The Duc d'Aumale has commissioned from MM. Olivier Merson and Olivier de Penne, for the Château at Chantilly, some large decorative panels having for their subjects, "Les Fêtes et les Chasses de la Maison de Condé," from the seventeenth century to the time of Louis Phillipe.——The "Société des Amis des Arts" at Nîmes is to inaugurate in May an exhibition in the Gallery of Arts generously presented by M. Jules Salles, Vice-President of the Society, to his native town.——The construction of some large barracks at Beauvais is talked of.——The Chamber of Deputies has taken into consideration a proposal of the Deputy of the Seine, M. Jacques, to declare as a scheme of "utilité publique" the making of a maritime canal between Paris and Rouen.——The Municipality of Nevers has opened a competition for the construction of two covered markets, to be called those of St. Martin and Sainte Agile.——M. Bourdelle, the sculptor, has completed the monument raised by subscription to the memory of Léon Cladel, the novelist. The monument, to be erected at Montauban, will be inaugurated in June.——We have to record the death of M. Georges Herscher, of the house of Geneste and Herscher, vice-president of the Société des Ingénieurs Civils, and a member of the Chamber of Commerce. He was at first known in connexion with the science of warming and ventilation, and subsequently devoted himself to questions of public hygiene. He contributed largely towards the better sanitation of towns and dwellings, and his works on these subjects are standard books of reference.——Some large exterior boulevards are to be constructed at Marseilles, partly in order to give more roadway for getting away from the docks and the crowded centre of the town.——There is a proposal to bring to Lyons the waters of the Lake of Annecy. This scheme, the cost of which would amount to some million francs, offers an opportunity for greatly improving the sanitary condition of the city.——It is announced that the Government has decided on the future site for storage of the decorations of the Opera Comique and the Paris Opera, which will be installed in barrack No. 49 on the Boulevard Berthier, near the Porte d'Asnières. This storehouse will be large enough to hold also the decorations of the Odéon.

INSANITARY CONDITION OF BOMBAY, CALCUTTA, AND MADRAS.—According to the annual report on sanitary measures in India, recently laid before Parliament, although good progress continued to be made with sanitary work in Bombay, parts of the town are very unhealthy. The death rate averaged 29·01, ranging from 3·02 in the water division to 44·41 per thousand in the Kamathipura section, inhabited to a large extent by the poorest of the population, The chief causes of disease are imperfect house drainage, ventilation, and the prevalence of overcrowding, the locality being densely populated. The place, which was in former days a swamp, has been filled up with city refuse, and the people live over this decomposing soil. In some of the other quarters there are formidable evils to be dealt with. In Byculla there is "still sewage in ditches and lanes." In Second Nagpada overcrowding is the principal defect. In Parel there are pools of sewage amidst dwellings, polluting air and ground, and oozing to lower levels, often beneath dwellings.——In spite of all the improvements effected during recent years, the sanitary condition of Calcutta is still bad. The death rate of 1891, 27·9, ranging by wards from 14·9 to 45·4 per 1,000, was higher than that of 1882 or any of the intervening years. Many parts of the town are as insanitary as they well can be. One great defect is the want of fresh air in the badly-ventilated quarters. It is considered that this can be remedied by demolition accompanied by the creation and enforcement of proper building laws and regulations, there not being any at present. Another is that the older sewers, when flooded, pollute the soil and subsoil water through leakage, and send forth, through their open manholes, offensive gases into the atmosphere. A third great defect is that, while an abundant supply of water is pumped into the town, owing to the supply being intermittent and also to the insufficient supply of stand pipes inside the bustees, the inhabitants are in much the same position as before the extension of the supply, and either obtain water from stand pipes at a distance, store a supply in vessels, or resort to their tanks and wells.——In view of the many and grave sanitary defects under which the town of Madras labours, it is disappointing that more progress in the work of improvement has not been effected. The year was signalised by a very heavy mortality averaging 52·6, and ranging from 43·3 to 72·8 per thousand in the various divisions. Among the causes of this high mortality are: defective drainage, and in a considerable part of the town no drainage system at all; a porous soil loaded with organic impurity; a putrid and fluctuating subsoil water rising comparatively near the surface; an indifferent water-supply; want of open spaces; crowded *parcherries* for the poor; overcrowded and ill-ventilated houses for the middle classes, in many cases directly connected with the subsoil water by wells in their interior; burial-grounds and slaughter-houses in the town. Matters which can only be remedied by a heavy expenditure of money and years of patient and systematic work.

MISCELLANEOUS.

SIR BENJAMIN BAKER ON TECHNICAL EDUCATION.—At the Queen's Hall of the People's Palace, Mile-end-road, on the 24th ult., Sir Benjamin Baker, K.C.M.G., F.R.S., distributed the certificates to the evening class students. The Master of the Worshipful Company of Drapers (Sir John H. Johnson) presided. The classes, which with some exceptions, are open to both sexes, without limit of age, are conducted with a view to giving students a practical and theoretical knowledge of the various trades and sciences, and to prepare them for the examinations of the Science and Art Department, the City and Guilds of London Institute, and of the Society of Arts. At the end of each session examinations are held and trade certificates awarded for the purpose of assisting students to obtain situations. The Chairman said that for some time Sir Benjamin Baker had been an invaluable member of the General Purposes Committee of the Governors of the People's Palace, and he had undertaken the principal part in the examination of the engineering classes. Sir Benjamin Baker said that the present was the first time that trade certificates had been given by the Governors of the People's Palace. He had no claim to their attention except as a technical student, which he had been all his life, and which he must be until the end of his career, unless he wished to lag behind in the progress of mankind. When he looked back at his own early days, he could not but envy the advantages students of the present day possessed. The first step to the attainment of knowledge was the recognition of one's own ignorance. The nation which neglected the proper education of its people in the sciences, arts, and manufactures must be content to occupy a secondary position. It was easy enough now to see how blind our predecessors had been on the subject of technical instruction, but so much remained to be done that he expected our descendants would express equal surprise at the slowness of their predecessors. Although our progress had been great, thanks to the liberality of the City Companies, he doubted whether we had succeeded in holding our relative position as regarded America, though he believed we had done so as regarded Germany and France. Technical education was in many respects now in the experimental stage, and no one could tell what would be the outcome of the present position, though it was impossible to doubt that it could be anything but good. It was necessary for students and teachers alike to remember that a certain amount of scientific and theoretical knowledge in the future must be considered as an indispensable element of success in the great battle of life. Success would depend upon their choosing the right field of labour in the first instance, and upon their boldly facing the difficulties which were sure to arise.

ROYAL CAMBRIAN ACADEMY OF ART.—The annual meeting of members and associates was held on the 27th ult., at Plas Mawr, Conway. Mr. H. Clarence Whaite, R.W.S., was re-elected President. Mr. Cuthbert C. Grundy, F.S.A., was re-elected vice-president, Mr. G. Swinford Wood and Mr. J. Pain Davies being appointed to the respective offices of honorary treasurer and secretary. The following artists were elected on the Council:—Messrs. George Cockram, J. H. Cole, B. Fisher, B. Fowler, P. Ghent, Anderson Hague, R. G. Harrison, Leonard Hughes, J. Johnson, J. Clinton Jones, Joseph Knight, A. F. Perrin, Charles Potter, J. C. Salmon, and W. Slater. Mr. John Finnie was elected a full member, and Messrs. S. Sidley, R.B.A., Arthur Baker, F.R.I.B.A., and G. Sheridan Knowles, R.I., were elected full members from the list of Associates. Messrs. Harold Hughes, A.R.I.B.A., Paul Knight, G. Hall Neale, Oliver Baker, and Reginald Smith were elected associates of the Academy out of a long list of candidates. The receiving days for the exhibition of 1894 were fixed for April 27 and 28; press day, May 9; private view, May 12; the Academy being opened to the public on May 14. Messrs. B. Fisher, B. Fowler, P. Ghent, and Anderson Hague, R.I., were appointed the Hanging Committee, and Messrs. W. J. Slater and B. Fowler were elected honorary auditors. Messrs. Arthur Baker and Harold Hughes have the care of Plas Mawr, Conway, the House of the Royal Cambrian Academy, where the annual exhibitions are held.

LEEDS BUILDERS' EXCHANGE.—The second annual meeting of the Leeds Builders' Exchange was held on the 23rd ult. in the Club-rooms, 19, Boar-lane, Leeds. The report and balance-sheet were read by the secretary, Mr. G. F. Wilkinson. The former detailed the successive steps by which the Builders' Exchange became a permanent institution, and blossomed into a social club, and then went on to describe the work it had done in connection with the Leeds Consolidation Bill on points which were considered detrimental to the interests of the building fraternity. Especial prominence was given to the proposed clause prohibiting the building of back-to-back houses, and in this connexion it was stated that the committee visited Hull at their own cost, in consequence of the laudation of the through houses for the working classes there, but that their careful inspection of these resulted in a conviction that the system prevailing in Leeds was in every way superior to the houses they saw in Hull. So far as the club was concerned, and in the promotion of which the executive freely acknow-

COMPETITIONS, CONTRACTS, AND PUBLIC APPOINTMENTS.

COMPETITIONS.

Nature of Work.	By whom Advertised.	Premiums.	Designs to be delivered.
*Six-Cell Destructor	Moss Side Loc. Bd.	.....	Mar. 1
*Workhouse Infirmary or Hospital	Whitehaven Union	20 Guineas	Mar. 5

CONTRACTS.

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
Additions to Warehouse, &c. Valley Mills, Manningham, Bradford	.....	Jas. Young & Co.	Feb. 6
Masonic Hall and Club, Exmouth	.....	Kerley & Ellis	do.
Seven Terrace Houses, Daisy Hill, Bradford, Yorks	.....	J. W. C. Atkinson	do.
Road Works, Heathorn-road, &c.	Maidstone U.S.A.	W. G. Scoones	do.
Street Works, Great Lever, &c.	Bolton R.S.A.	Mr. Atherton	do.
Pipe Sewer, Temple-road	Blackrock (Ireland) Township Commrs.	*Official*	do.
*Battery and Drill Shed	Admiralty	do.	do.
Workhouse Building	Waterford Union	do.	Feb. 7
*Works and Materials	Hammersmith Vestry	H. Mair	do.
Additions to Baths, Knightstone, Weston-super-Mare	.....	Price & Wooler	do.
Alterations, &c. to Marquis of Granby Inn, Durham	.....	Geo. Ord	do.
*Works and Materials	Westminster Vestry	G. R. W. Wheeler	do.
*Removal of Albion Hotel	Ramsgate Corporation	W. A. Valon	Feb. 8
Re-building Old Punch Bowl Inn, Beeston, Leeds	J. F. Carter	C. H. Thornton	do.
Guernsey Granite (3,000 tons)	Kensington Union	*Official*	do.
Villa Residence, Causeway, Maldon, Essex	C. S. Pollard	P. M. Beaumont	Feb. 9
Two Semi-detached House, West Park-street, Dewsbury	.....	Holtom & Fox	do.
Residence and Stabling, Barkerend, Bradford	.....	Jas. Ledingham	do.
Vicarage House, Ogmore Vale, Bridgend	.....	Halliday & Anderson	do.
Two Wool Warehouses, Clarence and Nelson Streets, Bradford	.....	Brayshaw & Dixon	Feb. 10
Warehouses, &c. Sandes-avenue, Kendal	J. Atkinson	S. Shaw	do.
Mission Room, Buttery Well-lane, Kendal	.....	do.	do.
Cast-iron Pipes, &c.	Burnley U.R.S.A.	S. Edmondson	do.
Draining, Levelling, &c. East-street	Batley Town Council	H. Dearden	do.
Additions to Workhouse	Cardiff Union	E. Seward	do.
Eighty Houses, Penyrheol, Tylorstown, S. Wales	Stanley Building Club	T. F. Phillips	Feb. 12
Re-building Brown's Bridge, near Strathaven, N.B.	Lanark County Council	Leslie & Reid	do.
Main Drainage Works (Contracts Nos. 4 and 5)	Newbury Town Council	J. Anstie	do.

CONTRACTS—*Continued.*

Nature of Work or Materials.	By whom Required.	Architect, Surveyor, or Engineer.	Tenders to be delivered.
*Hire and Repair of Harness	Islington Vestry	.....	Feb. 12
Sewers, &c. Tennyson-road, Wibsey	North Brierley L. B.	P. Ross	do.
Extension of Electric Lighting Station, Leeds	Yorks House-to-House Electric Co. Lim.	Milnes & France	do.
Road Materials, Birmingham	Warwick C. C.	J. Willmot	Feb. 13
*Works and Materials	St. Mary, Battersea, Vestry	J. T. Pilditch	Feb. 14
Baptist Chapel, Cymmer, Porth, South Wales	H. Abraham	.....	do.
Houses, Blue Green, nr. Ashton-under-Lyne	Ashton-under-Lyne, &c. Waterworks	J. Eaton & Sons	do.
Trunk and Branch Sewers	Moseley (Lancs.) T.C.	T. S. M'Callum	do.
*Broken Granite	Southend-on-Sea Corp.	*Official*	do.
*Making-up and Paving Road	Fulham Vestry	J. P. Norrington	do.
Additions to School Buildings, Paul, Cornwall	Paul School Board	N. C. Coheat, Jun.	Feb. 15
*Various Works	Stoke Newington Ves.	*Official*	Feb. 16
*Eight Concrete Groynes	Southend-on-Sea Corp.	C. T. Copley	Feb. 19
*Engine and Boiler House, Chimney, Cottages, &c.	Newark Corp.	H. Rofe	do.
*Road and Sewer Repairs, &c. Broken Granite	Limehouse Bd. of Wks.	*Official*	do.
*Road and Sewer Works	West Ham Sch. Bd.	Newman & Jacques	Feb. 20
*Tar-paving Playgrounds, &c. of Schools	do.	do.	do.
Flags, Granite and Kerbstones	Birkenhead Corp.	C. Brownridge	Feb. 21
Infirmary, Vagrant Wards, &c. Chell Workhouse	Wolstanton & Burslem Union	Ford, Slater & Walley	Feb. 26
*Idiots' Block	Hants County Asylum	B. S. Jacobs	do.
*Underground Conveniences, Billingsgate	Commrs. of Sewers	*Official*	Feb. 27
*Municipal Buildings, Police Offices, &c.	Rotherham Corp.	R. J. Lovell	Mar. 1
Lunatic Asylum, Holywell, Antrim, Ireland	Board of Control, &c. of Lunatic Asylums	J. Lanyon	Mar. 5
*Town Hall and Public Offices	Llanelly Local Board	W. Griffiths	Mar. 10
*Twelve Cottages, and Completion of Others, Abertillery	.....	Bishop & Pritchett	No date
Dwelling Houses, New England, Peterborough	Mr. Redhead	J. G. Stallebrass	do.
Iron Church, Park-road, Newcastle	J. Archbold	.....	do.
*Schools, Keynsham, near Bristol	.....	E. H. Lingen Barker	do.

PUBLIC APPOINTMENTS.

Nature of Appointment.	By whom Advertised.	Salary.	Applications to be in.
*Clerk of Works	Hackney P.B. & W. Com.	4l. 4s.	Feb. 7
*Surveyor and Inspector of Nuisances	Banbury Town Council	200l.	Feb. 10

Those marked with an Asterisk (*) are advertised in this number. *Competitions, p.* iv. *Contracts, pp.* iv., vi., vii., viii. *and* ix. *Public Appointments, pp.* xxiii. *and* xxv.

ledged their indebtedness to the generous support given by the firms dealing in building materials, the report showed that it had been a financial success, a dividend of 7½ per cent. upon the paid-up capital having been declared for the past year.

THE SLATE TRADE.—The past year has been one continuance of good steady demand with slightly increased prices. In the Carnarvonshire quarries the Government returns, when issued, will, we believe, show an increased make, and as the shipments to Australia fell off for a time, owing to financial difficulties, the increased sales can only be accounted for by a larger amount of building at home, caused probably by the demand for better houses for the working-classes. In the Merionethshire quarries the make will be slightly less, owing to labour troubles in the Llechwedd Quarry, a quarry looked upon as a pattern in all dealings between masters and men, Messrs. Greaves, the proprietors, having a practical knowledge of quarrying, and being always well in touch with their men. The latter wished certain men employed to whom the owners objected, and after four months' loss of wages the men went to work on the owners' terms. Several cargoes of French slates have been imported, but they are not considered equal in quality to the best Welsh. We believe the current year will show a falling off in make, as serious falls of rock have occurred in several quarries, and no new ones have been opened to supply the deficiency.

CLOCK, SHEPTON BEAUCHAMP CHURCH, SOMERSETSHIRE.—A large clock, which has two dials and chimes the Cambridge quarters upon four bells, has just been erected in this church. All the latest improvements have been introduced in the mechanism. The whole of the work has been executed by Messrs. John Smith & Sons, Midland Clock Works, Derby, who made the clock at St. Paul's Cathedral.

MEETINGS.

FRIDAY, FEBRUARY 2.

Architectural Association.—Mr. E. Woodthorpe, M.A., on "Party Walls." 7.30 p.m.

Royal Institution.—Mr. T. J. Cobden-Sanderson on "Bookbinding: its Processes and Ideal." 9 p.m.

Sanitary Institute (Lectures and Demonstrations for Sanitary Officers).—Sir Douglas Galton on "Ventilation, Warming, and Lighting." 8 p.m.

Institution of Civil Engineers (Students' Meeting).—Mr. H. C. B. Campbell on "Survey of the Valley of the Varder and the Plain of Karaferin in Macedonia." 7.30 p.m.

SATURDAY, FEBRUARY 3.

Sanitary Inspectors' Association.—Annual Dinner, First Avenue Hotel, Holborn, W.C. 6 p.m.

Sanitary Institute (Lectures and Demonstrations for Sanitary Officers).—Visit to Friern Barnet Sewage Works. 3 p.m.

Queen's College, Cork.—Mr. Arthur Hill on "The History of Architecture." IV. 3 p.m.

MONDAY, FEBRUARY 5.

Royal Academy of Arts.—Professor Aitchison, A.R.A., on "The Advancement of Architecture." III. 8 p.m.

Surveyors' Institution.—Mr. H. Blackbourn on "The London Streets and Buildings' Bill, 1894, of the London County Council." 8 p.m.

London Institution.—Mr. Lewis F. Day on "Art About Us." 5 p.m.

Society of Arts (Cantor Lectures).—Mr. Frank Clowes, D.Sc., on "The Detection and Measurement of Inflammable Gas and Vapour in the Air." III. 8 p.m.

Liverpool Architectural Society.—Mr. Basil Champneys on "The Relations of the Ideal to the Practical in Architecture." 6.30 p.m.

Leeds and Yorkshire Architectural Society.—Paper by Mr. E. Guy Dawber. 7.30 p.m.

TUESDAY, FEBRUARY 6.

Institution of Civil Engineers.—Mr. Boverton Redwood on "The Transport of Petroleum in Bulk." 8 p.m.

Sanitary Institute (Lectures and Demonstrations for Sanitary Officers).—Mr. H. Law on "Principles of Calculating Areas, Cubic Space, &c.: Interpretation of Plans and Sections to Scale." 8 p.m.

Society of Biblical Archæology.—(1) Dr. J. H. Gladstone, D.Sc., on "Ancient Metals from Tell-el-Hesy, &c."; (2) Paper by Mr. P. le P. Renouf, President. 8 p.m.

Glasgow Architectural Association.—Mr. W. Tait Conner on "Planning of Theatres." 8 p.m.

WEDNESDAY, FEBRUARY 7.

Royal Archæological Institute.—(1) Mr. R. Wright Taylor, F.S.A., on "A Stamped Leather Box of the Fifteenth Century"; (2) Mr. C. T. Davis on "A Monumental Brass from Aberdeen"; (3) Mr. Mill Stephenson, F.S.A., on "Some Monumental Brasses from Surrey." 4 p.m.

Institution of Civil Engineers.—Students' Visit to the Locomotive Works of the Great Eastern Railway, Stratford. 2.30 p.m.

British Archæological Association.—(1) Mr. T. Cann Hughes on "An Antiquarian Ramble in Suffolk"; (2) Mr. Andrew Oliver on "Ecclesiastical Antiquities," with illustrations; (3) Mr. A. C. Fryer on "A Belfry Foundry." 8 p.m.

Sanitary Institute (Lectures and Demonstrations for Sanitary Officers).—Visit to Disinfecting Station at St. Pancras. 3 p.m.

Society of Arts.—Mr. W. Worby Beaumont on "Automatic Balance of Reciprocating Machinery, and Prevention of Vibration." 8 p.m.

Builders' Foremen and Clerks of Works' Institution.—Ordinary meeting of the members. 8.30 p.m.

Edinburgh Architectural Association.—Mr. J. M. Gray on "Engraving on Metal: its Technical Processes and Artistic Results." 8 p.m.

THURSDAY, FEBRUARY 8.

Royal Academy of Arts.—Professor Aitchison on "The Advancement of Architecture." IV. 8 p.m.

London Institution.—Mr. J. J. Harris Teall, M.A., on "The Life History of a Mountain Range" (illustrated). 6 p.m.

Institution of Electrical Engineers.—Paper by Major-General C. E. Webber, Past President, entitled "Some Notes on the Electric Lighting of the City of London." 8 p.m.

Society of Arts (Indian Section).—Mr. E. O. Walker, C.I.E., on "Telegraphic Communication between England and India: its Present Condition and Future Development." 4.30 p.m.

Society of Antiquaries.—8.30 p.m.

FRIDAY, FEBRUARY 9.

Sanitary Institute (Lectures and Demonstrations for Sanitary Officers).—Mr. J. Wallace Peggs on "Water Supply, Drinking Water, Pollution of Water." 8 p.m.

Junior Engineering Society.—Mr. A. H. Dykes on "The Construction and Working of Electro Motors." 8 p.m.

SATURDAY, FEBRUARY 10.

Royal Institution.—Lord Rayleigh, M.A., on "Light, with Special Reference to the Optical Discoveries of Newton." I. 3 p.m.

Sanitary Institute (Lectures and Demonstrations for Sanitary Officers).—Visit to Express Dairy Company's Farm, College Farm, Finchley. 3 p.m.

Queen's College, Cork.—Mr. Arthur Hill on "The History of Architecture." V. 3 p.m.

RECENT PATENTS:

ABSTRACTS OF SPECIFICATIONS.

1,841.—CASEMENT WINDOWS, &c.: *J. H. Jones and others.*—According to this invention, a double-rebated sill and an inclined rebate on the jamb, with a rising and falling transom, provide in casement windows and doors a weather-tight stile and a better fastening.

3,591.—VENTILATING: *W. T. Charlton.*—To withdraw steam or vapour from boiler-houses, laundries, and the like, a telescopic or sliding-tube, with the lower end cone-shaped, is used.

3,914.—LEVELS: *J. Allan.*—This invention consists of a cased-in level, in shape like a T-square, which has an indicator, actuated by a weight and two cords, which shows the levels and angles on which the base is placed.

4,129.—METAL LATHING: *W. W. Bostwick.*—Describes improvements in machinery adapted to produce flexible metal lathing.

4,901.—IMPROVEMENTS IN WATER CLOSETS: *C. M. St. Amory and another.*—A douche of water is made to play on the pan when required by means of a movable pipe and tap controlling the same.

7,627.—CUPBOARD AND DOOR-BOLT: *W. E. Mouro.*—According to this invention, a bolt with handle is fixed in a metal case stamped out of a single piece—the case having at its back end a curved slot. By reason of the handle of the bolt being forced to travel along the inclined or curved slot, the act of turning the handle up or down locks or unlocks the bolt.

8,211.—SAWING STONE: *J. T. Riddough.*—In saws used for cutting stone, grooves or ridges or furrows are cut in the blade leading from the upper to the lower edges, and

facilitating the passage of the grit used in operating upon the stone.

9,825.—PAINT: *J. W. Overton.*—The paint which is the subject of this patent is composed principally of the mineral known as "rutile," a dioxide of titanium, ground, and mixed with coal-tar or bituminous compound.

20,134.—DOOR BOLTS: *E. Gorton.*—To provide a catch or locking-piece to the base-plate is affixed a catch-piece with an inclined plane. When the bolt is "shot," the catch is raised by the bolt acting upon the inclined plane, which then falls and locks the bolt. A thumb-piece is provided to raise the catch when it is desired to release the bolt.

NEW APPLICATIONS FOR LETTERS PATENT.

JANUARY 15.—855, W. Woolard, Method of Putting together any number of Blocks of Pine or Lime or other Woods to form Cutting-Boards, &c.—861, A. Moritz, Fire-proofing Felt.—879, D. Nicholas, Mortising Machines.—880, C. Holmström, Preventing the Freezing of Water in Pipes and Cisterns.—889, E. Hutchins, Ventilating Apparatus for Window-sashes.—898, A. Brown, Tool or Auger Bit.—903, G. Bowser and E. Abell, Reciprocating Machine for Moulding and Dressing Stone used for Building, Drainage, &c.

JANUARY 16.—921, F. Ballard, Burning Bricks in an Improved Kiln.—938, F. Ballard, Utilising the Heat given off from Brick-burning Kilns.—942, J. Stow, Door and other similar Bolts.—961, J. Chevalier, Saws for Cutting Stone and similar substances.

JANUARY 17.—1,016, G. Kirk, Rain-water Channels.—1,026, J. Hancock, Syphons for Cisterns for Water-closets.—1,038, J. Chapman, Joiners' Ratchet and other Braces.—1,047, H. Birkbeck, Collapsible Doors.—1,075, G. Brasse, Holding, Locking, and Operating Window-sashes.

JANUARY 18.—1,095, J. Gutgemann, Fasteners for Windows and other Sliding Frames.—1,126, J. Moseley, Covering for Walls, Ceilings, &c.—1,142, F. Smith, Bakers' Ovens.—1,157, H. Lake, Artificial Marble.

JANUARY 19.—1,167, A. Stopes, Apparatus to Prevent Explosion of Kitchen and other Circulating Hot-water Boilers.—1,175, T. Cowell, Screw-drivers.—1,176, T. Joyce, Water Pipes.—1,181, C. Wicksteed, Drill Ratchet Braces.—1,203, W. Taylor, Door-stop.—1,209, A. Carey, Chimney Cowl.

JANUARY 20.—1,253, T. Clark, Coach Painting and Painting in general.—1,254, A. Hutchinson, Discharge and Waste-water Valve for Baths, Tanks, &c.—1,283, C. Ellis, Ventilator for Ventilating Buildings, Sewers, &c.—1,294, T. Williams, Door Handles or Knobs.—1,304, W. Judd, Preventing Water-pipes Bursting from Frost.

PROVISIONAL SPECIFICATIONS ACCEPTED.

23,373, H. Burnet, Drain and Soil-pipe Testing Apparatus.—23,991, W. Monro, Spigot for Earthenware Fittings, Drain-pipes, &c.—24,296, S. Linscott and J. Tinsdale, Fastenings for Windows.—24,380, W. Nicol, Window-sashes.—24,511, H. Fuller and T. Wyatt, Weather Strip.—24,593, S. Wilson, Fastener for Window-sashes, &c.—24,658, J. Young, Weather Bars for Casement Windows.—24,804, A. Hall, Connecting Pipes.—24,813, F. Scruby and W. Bowler, Fireproof Wall and Ceiling Covering or Decoration.—25,037, T. Downie, Window-sashes.—8, J. Blandford, Chimney Pot.—238, A. Jones, Chimney Pots or Cowls for Chimney and Ventilating Shafts.—270, A. Read, Fastening and Unfastening Window Beads.

COMPLETE SPECIFICATIONS ACCEPTED.

(Open to Opposition for Two Months.)

4,919, W. Kinnerney, Combined Screw and Nail.—6,547, H. Hansen and W. Walker, Ventilators.—17,514, W. Smith, Protecting Timber Structures.—20,656, A. Mirza, Securing Doors of Strong-rooms, Safes, &c.—22,940, T. Hilderbrand, Roofing Tiles or Plates.

SOME RECENT SALES OF PROPERTY:

ESTATE EXCHANGE REPORT.

JANUARY 24.—By *Perkins & Cæsar:* 75, 77, Abbey-st., Bermondsey, f., r. 78*l.*, 730*l.*—By *Furber, Price, & Furber:* 24, Craven-rd., Paddington, u.t. 43 yrs., g.r. 10*l.*, r. 100*l.*, 1,220*l.*; 6, Craven-rd., u.t. 45 yrs., g.r. 10*l.*, r. 90*l.*, 960*l.*; 14, Bishop's-rd., u.t. 47 yrs., g.r. 20*l.*, r. 130*l.*, 1,750*l.*

JANUARY 25.—By *D. Watney & Sons:* A profit rental of 114*l.* per annum, Holloway-rd., u.t. 10 yrs., 600*l.*—By *A. & A. Field:* 116 and 118, Buxton-st., Mile End; 2 and 3, Buttress-st., f., 710*l.*; 6, Canon-pl., Whitechapel, f., r. 28*l.* 16s., 300*l.*—By *Stimson & Sons:* 23 and 25, Evandale-rd., Brixton, u.t. 20 yrs., g.r. 5*l.* 2s., r. 58*l.*, 305*l.*; 212, Kennington-rd., Kennington, and 1 and 2, Lollard-st., u.t. 33 yrs., g.r. 90*l.*, r. 195*l.*, 470*l.*; 50, Heygate-st., Walworth, u.t. 49 yrs., g.r. 5*l.*, r. 37*l.* 10s., 335*l.*; l.g.r. of 50*l.*, Wandsworth-rd., &c., u.t. 15 yrs., 450*l.*; 13 to 19, Thorn-ter., Mitcham, u.t. 86 yrs., g.r. 24*l.* 10s., 180*l.*—By *Newbon & Co.:* 9, 11, and 15, Milton-rd., Walthamstow, f., 450*l.*—By *Farebrother, Ellis & Co.:* 1, Kensington Palace Gardens, Kensington, u.t. 49 yrs., g.r. 60*l.* 5s., 7,500*l.*; f.g.r. of 30*l.*, St. John-st.-rd., Clerkenwell, reversion in 7 yrs., 2,890*l.*; f.g.r. of 46*l.*, St. John-st.-rd., reversion in 9 yrs., 2,950*l.*; "The Railway Tavern," Commercial-rd., Limehouse, f., r. 118*l.*, 2,500*l.*; 45, 47, and 49, Ropemaker's Fields, f., r. 61*l.* 2s., 450*l.*; 20, 22, and 24, Church-st., Bethnal Green, f., r. 140*l.*, 1,590*l.*; 17 and 18, Ebor-st.; and "The King's Head" Public House, f., 3,170*l.*; 28, 30, and 32, Church-st.; and 10 and 12, Ebor-st., f., 1,840*l.*; "The Crown" Public House, Church-st., f., r. 160*l.*, 4,100*l.*; 36 and 38, Church-st., f., 610*l.*; 44 to 50 (even), Church-st., f., 1,750*l.*; 58 and 60, Church-st.; and 25 to 29, Club Row, f., 1,960*l.*; 1, 1A, 3, and 5, Chance-st., f., 700*l.*; 2, 4, 6, and 8, Ebor-st., f., 1,210*l.*; f.g.r. of 17*l.*, Ebor-st., reversion in 7 yrs., 1,350*l.*

JANUARY 26.—By *Baker & Sons:* "West Mead Farm," Carshalton, and 18½ acres, f., 2,900*l.*; two plots of f. land, 40*l.*: f.g.r. of 49*l.*, St. Paul's-rd., Highbury, reversion in 89 yrs., 1,270*l.*; f.g.r. of 60*l.*, ditto in 89 yrs., 1,525*l.*; f.g.r. of 115*l.*, Holloway-rd., reversion in 90 yrs., 3,010*l.*—By *Green & Son:* 13, High-rd., Stamford Hill, u.t. 89 yrs., g.r. 8*l.* 8s., 250*l.*; 1 to 19, and 23 to 41 (odd), Astbury-rd., Peckham, u.t. 79 yrs., g.r. 90*l.*, 3,930*l.*; 18 to 60 (even), Astbury-rd., u.t. 79 yrs., g.r. 99*l.*, 4,110*l.*; 61 to 79, 85 to 93, and 99 to 107 (odd), Astbury-rd., u.t. 79 yrs., g.r. 95*l.*, 3,400*l.*; 62 to 112 (even), Astbury-rd., u.t. 79 yrs., g.r. 117*l.*, 3,810*l.*; 1 to 13, 15, 16, 17, 20 to 29, Colls-rd., u.t. 79 yrs., g.r. 123*l.* 10s., 4,350*l.*; 30 to 42, Colls-rd., u.t. 79 yrs., g.r. 63*l.*, 2,390*l.*

[*Contractions used in these Lists.*—F.g.r. for freehold ground-rent; l.g.r. for leasehold ground-rent; i.g.r. for improved ground-rent; g.r. for ground-rent; r. for rent; f. for freehold; c. for copyhold; l. for leasehold; e.r. for estimated rental; u.t. for unexpired term; p.a. for per annum; yrs. for years; st. for street.; rd. for road; sq. for square; pl. for place; ter. for terrace; cres. for crescent; yd. for yard, &c.]

PRICES CURRENT OF MATERIALS.

TIMBER.

Greenheart, B.G.	ton	9/0/0	0/0/0
Teak, E.I.	load	9/10/0	15/10/0
Sequoia, U.S.ft.cu		2/3	2/6
Ash, Canada	load	2/10/0	3/15/0
Birch, do.		2/10/0	3 10 0
Elm, do.		3/5/0	4/10/0
Fir, Dantsic, &c.		1/5/0	2/10/0
Oak, do.		2/15/0	5/0/0
Canada		5/10/0	7/0/0
Pine, Canada	red	2/15/0	3/5/0
Do.	Yellow	2/5/0	4/10/0
Lath, Dantsic, fath		4/10/0	5/10/0
St. Petersburg		5/0/0	6/10/0
Wainscot, Riga, &c., log		2/5/0	4/10/0
Odessa, crown		2/5/0	4/10/0
Deals, Finland			
2nd & 1st std		8/0/0	10/10/0
Do. 4th & 3rd		7/10/0	8/0/0
Do. Riga		7/10/0	9/0/0
St. Petersburg, 1st yellow		10/0/0	13/10/0
Do. 2nd yellow		8/0/0	9/0/0
Do. white		8/10/0	11/0/0
Swedish		8/0/0	16/0/0
White Sea		8/0/0	16/10/0
Canada, Pine 1st		22/10/0	29/10/0
Do. do. 2nd		17/0/0	18/10/0
Do. do. 3rd, &c.		7/10/0	10/10/0
Do. Spruce, 1st		9/0/0	11/0/0
Do. do. 3rd & 2nd		6/10/0	7/15/0
New Brunswick		6/0/0	7/5/0
Battens, all kinds		3/0/0	15/0/0
Flooring boards, sq., 1 in. prep, 1st		0/10/6	0/15/0
Do. 2nd		0/7/6	0/13/0
Other qualities		0 5/3	0/7.0
Cedar, Cuba	ft.	/4	/4½
Honduras, &c.		/3½	/4½
Mahogany, Cuba		/3½	/6
St. Domingo, cargo av.		/3	1/6
Mexican do. do.		/3½	/4
Tobasco do. do.		/3½	/6
Honduras do.		/4	/5½
Box, Turkey	ton	4/0/0	13/0/0
Rose, Rio		8/0/0	20/0/0
Bahia		7/0/0	18/0/0
Satin, St. Domingo		0/0/6	0/1/3

TIMBER (*continued*).

Satin, Porto Rico		0/0/7	0/1/6
Walnut, Italian		0/0/3½	0/0/7

METALS.

Iron—Pig, in Scotland	ton	2/3/10½	0/0/0
Bar, Welsh, in London		5/17/6	6/0/0
Do. do. at works in Wales		5/7/6	5/10/0
Do. Staffordshire, in London		6/0/0	6/10/0
COPPER—British cake and ingot		43/10/0	44/0/0
Best selected		44/10/0	45/0/0
Sheets, strong		53/0/0	0/0/0
Chili bars		41/7/6	42/12/6
YELLOW METAL	lb	0/0/4¾	0/0/5
LEAD—Pig, Spanish	ton	9/6/3	9/7/6
English com. brands		9/8/9	9/10/0
Sheet, English, 6 lbs. per sq. ft. and upwards		11/0/0	0/0/0
Pipe		11/10/0	0/0/0
ZINC—English sheet	ton	19/10/0	0/0/0
Vieille Montagne		20/0/0	0/0/0
TIN—Straits		71/0/0	71/10/0
Australian		71/5/0	71/15/0
English Ingots		75/15/0	76/0/0
Banca		76/0/0	77/0/0
Billiton		73/0/0	74/0/0

OILS.

Linseed	ton	20/0/0	20/5/0
Cocoanut, Cochin		33/0/0	0/0/0
Do. Ceylon		24/10/0	0/0/0
Palm, Lagos		25 0/0	0/0/0
Rapeseed, English pale		23/0/0	23/10/0
Do. brown		21/10/0	0/0/0
Cottonseed ref.		20/15/0	22/10/0
Oleine		22/0/0	24/0/0
Lubricating, U.S.		4/0/0	5/0/0
Do. refined		5/0/0	12/0/0
TAR—Stockholm	barrel	0/19/6	1/0/0
Archangel		0/12/6	0/0/0

TENDERS.

[Communications for insertion under this heading should be addressed to "The Editor," and must reach us *not later than* 10 *a.m. on Thursdays.*]

ABERDARÉ.—For the erection of twelve dwelling-houses at Aberdare. Mr. Charles H. Elford, architect, Aberdare:—

Richards	£4,674	Jno. Owen	£2,520
W. Bowers & Son	3,920	Ed. Owen	2,385
W. Knight	3,796	Samuel Hawkins, Merthyr (accepted)	2,100
John Jones	3,540		

BEDFORD.—Accepted for further works of sewering and road-making on the Queen's Park Building Estate, for Mr. D. C. Preston. Mr. Richard Lund, surveyor, 8, St. Pauls-square, Bedford:—
Jesse Jackson, Leyton, E. £710 0 0

CONNOR (Ireland).—For the erection of a General Assembly Presbyterian Church. Messrs. Young & McKenzie, architects, Belfast:—

John Trew	£2,800 0 0	McManns & Son	£2,500 0 0
James Dallas	2,708 17 2	John McFarland	2,325 0 0
Robert Colwell	2,700 0 0	B. Adair & Son, Ballymena*	2,214 8 0
Robert Colhoun	2,693 0 9		

Accepted.

ELLESMERE (Salop).—For the construction of sewerage works, Overton, for the Rural Sanitary Authority. Mr. W. Wyatt, Engineer, Pride Hill Chambers, Shrewsbury:—

W. Vaughan	£309 17 0	Williams & Son, Penley, Ellesmere*	£157 5 10
Jn. P. Jones	230 10 0		
T. Brown	160 2 11		

* Accepted.

HASTINGS.—For the supply of cast-iron water-mains, for the Rural Sanitary Authority. Messrs. Jeffery & Skiller, surveyors, 11, Wellington-square, Hastings:—

	Per ton, 3 in.	Per ton, 4 in.	Per cwt. extras.
Laidlaw & Son	£5 10 0	£3 8 6	£0 10 0
Jukes, Coulson, Stokes, & Co.	5 6 3	5 6 3	Per ton. 8 10 0
James Duke	5 2 0	4 17 6	9 0 0
Stanton Ironworks Co.	5 0 0	4 16 9	8 0 0
James Gibbs & Co.	4 19 0	4 18 0	8 0 0
Firmstone Bros.	4 18 9	4 17 6	7 17 6
Clay Cross Co.	5 3 6	5 2 6	8 10 0
H. J. Skelton & Co., London (accepted)	4 19 0	4 16 3	8 0 0

HASTINGS.—For laying a drain from Springfield-road to Hollington-lane, St. Leonards, for the Rural Sanitary Authority:—

J. Geary	£220 0	Jonathan Piper, Hastings (accepted)	£89 16
Alfred King	112 0		
E. Gutsell	110 9	W. Meals	75 14

ISLAND OF LUING (N.B.).—For the construction of a pier of concrete, iron, and timber, Blackmill Bay, for the Argyll County Council. Mr. G. Woulfe Brenan, C.E., Albany-street, Oban. Quantities by Engineer:—

P. Bain	£1,508 15 6	J. Adams & Co.	£1,302 0 0
Law & Son	1,501 13 9	Alexander McLean	1,209 7 8
W. Kidd & Co.	1,336 7 11	Donald Mackay	1,080 9 2

LIDFORD (Devon).—For the erection of a wing to the "Manor Hotel," Lidford station, for a company. Messrs. Ward & Chowen, architects. Quantities by architects:—

Wm. C. Shaddock	£2,113	Ambrose Andrews	£1,215
Lapthorn & Co.	1,488	J. Rosekilly	1,145
W. Wiffen	1,366	H. B. Fuge	1,100
P. Blowey	1,360	Petherick Bros, Hatherleigh* (Accepted.)	1,105
Jas. Julian	1,275		
W. G. Goad	1,220		

LONDON.—For the supply of 250 tons Guernsey granite lumps, for the Poplar Union Guardians:—

	Per ton s. d.		Per ton s. d.
J. L. Lyon & Co.	9 11	W. Griffiths	9 6
W. Muir	9 7	W. Gibbs	8 7
G. Le Maitre	9 6	R. L. & J. Fennings	8 6

LONDON.—For laying 185 ft. glazed stoneware pipe sewers, manholes, &c., Compton-passage and Allen-street, for the Clerkenwell Vestry:—

J. Webb	£198	Thos. Adams	£119
C. W. Killingback & Co.	125	Porter & Harrison, Aldershot (accepted)	110
John Mowlem & Co.	125		

LONDON.—For the execution of wood-paving works, Bow-road, for the Poplar Board of Works. Mr. G. F. Holt, Surveyor:—

	Deal. s. d.	Granite. s. d.
G. J. Anderson	8 6	11 6
The Acme Wood Flooring Company	8 0	12 0
E. Parry	9 6	12 0
G. G. Kutty	9 2	12 6
Wm. Griffith	11 0	13 6
The Improved Wood Pavement Company, 46, Queen Victoria-street	7 9*	12 5

* Accepted.

LONDON.—For making-up and paving Doria-road and St. Alban's-terrace, for the Fulham Vestry. Mr. J. P. Norrington, C.E., Surveyor, Town Hall, Walham Green:—

	Doria Road.				St. Alban's Terrace.
	Roadway. £	York. £	Adamant. £	Imperial. £	Road and Footway (*in situ*). £ s.
Imperial Stone Co.	—	—	—	160	46 0
John Ball	264	—	—	—	—
J. Mears	270	—	—	—	—
Nowell & Robson	317	203	—	—	—
G. Wimpey & Co.	252	196	142	—	59 0
H. J. Greenham	265	—	—	—	—
E. Parry	265	—	—	—	55 15

LONDON.—For works at No. 140, Harley-street, W. Mr. H. H. Gordon, architect:—

Higgs	£1,345	Barker & Co.	£1,057
Eddie	1,097		

LONDON.—For alterations at the "Two Brewers," Bermondsey for Mrs. Bassett. Messrs. Hodson & Whitehead, architects, Finsbury-square, London:—

Dixon	£649	F. H. Hopkins	£555
White	619	Wandle	503

LONDON.—For alterations and completion, 58A, Brompton-road, for Messrs. Taylor & Sons. Mr. W. H. S. Thompson, architect:—

Holloway	£926	Eddie	£819
Carmichael	884	Gord	812
Gregory	869	Lordon	677

MANSFIELD.—For sinking a well three miles from the town on the Southwell-road, for the Corporation. Mr. George Hodson, M.Inst.C.E., Loughborough:—

Radcliffe & Co.	£13,814	Timmins & Sons	£7,245
Thomas Smart	10,245	H. Vickers	6,900
J. H. Vickers	7,590	H. Shardlow	6,576
J. Tomlinson	7,394	J. F. Price, Nottingham*	5,275

* Accepted.

MIDDLESBROUGH.—For the erection of new warehouse for the owners of the Middlesbrough Estate, Ltd. Messrs. Weatherill & Whipham, architects, Stockton-on-Tees. Quantities by the architects:—

J. Johnson	£2,011 13 0	T. D. Ridley, Middlesbrough*	£1,900 0
A. J. Cooke	1,973 12 8		

*Accepted.

PALLAS GREEN (co. Limerick).—Accepted for the erection of a dwelling-house, Kilteely. Mr. Walter G. Doolin, architect, 20, Ely-place, Dublin:—
Nicholas Gaffney, Kilmallock, co. Limerick £570 0 0

SOUTHAMPTON.—For alterations at the "Wheatsheaf" Hotel, Bridge-street, Southampton, for Messrs. Scrace & Co. Mr. Stansfield Greenwood, architect, Portland-street, Southampton:—

F. H. Hopkins	£1,135	Court	£802
Stephens	867		

WALTHAMSTOW.—For the erection of public library buildings, High-street, for the Local Board. Mr. J. Williams Dunford, architect, 100C, Queen Victoria-street, London, E.C.:—

Castle & Son	£3,155 0 0	S. J. Scott	£2,587 0 0
W. Watson	3,143 0 0	Martin & Co.	2,512 0 0
Barrett & Power	2,939 0 0	J. Holland	2,460 0 0
L. H. Lipscomb	2,806 0 0	F. J. Coxhead	2,373 0 0
J. A. Reed	2,879 0 0	S. Hipwell	2,360 0 0
A. Morgan	2,694 0 0	J. W. Best, Walthamstow*	2,349 16 2
J. Barton	2,608 0 0		
Kerridge & Shaw	2,632 0 0		

* Accepted.
[Architect's estimate, £2,405 0 0.]

WICK (N.B.).—For the supply of 3½ miles cast-iron water-pipes, the erection of concrete reservoir, &c., Lybster and Latheronwheel, for the Caithness County Council. Mr. Jno. J. Cronin, C.E., Wick:—

	Lybster.	Latheronwheel.
Rod. Fraser	£1,127 9 4	£216 13 6
Ross & Co.	1,123 5 4	256 12 4
Chisholm & Son	1,062 2 3	231 1 9
W. Johnston & Son	962 2 11	—
Tait & Reid	950 18 11	209 1 0
B. Dunbar	946 3 9	—
T. Munro	895 18 0	218 3 8

The Engineer's estimate for Lybster was £940, and for Latheronwheel £165.

WIMBLEDON.—For making up Mansel and Rostrevor roads, for the Local Board:—

Mansel-road.

Fry Bros.	£666	Iles, Wimbledon (accepted)	£535
Adams	632		

Rostrevor-road.

Adams	£289	Iles (accepted)	£245
Fry Bros.	273		

WOTTON-UNDER-EDGE (Glos.).—For the execution of water supply works, for the Dursley Union Rural Sanitary Authority. Mr. A. P. I. Cotterell, C.E., Lonsdale Chambers, Baldwin-street, Bristol:—

Beachim & Belmont	£4,783	0	0	Cruwys & Holbrough	£3,283 18 2
King & Sons	3,997	0	0	Lloyd & Powell	3,220 7 0
R. R. Facey	3,550	0	0	Love & Waite	3,200 0 0
W. Cowlin & Son	3,530	0	0	S. Ambrose	3,155 9 11
J. Roach & Son	3,358	9	8	Porter & Harrison, Aldershot*	3,100 0 0
E. Stallard	3,325	0	0		
E. H. Toulmin	3,290	6	9		

* Accepted.

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J. D. W. (below our mark).—W. B. (thanks; not required).

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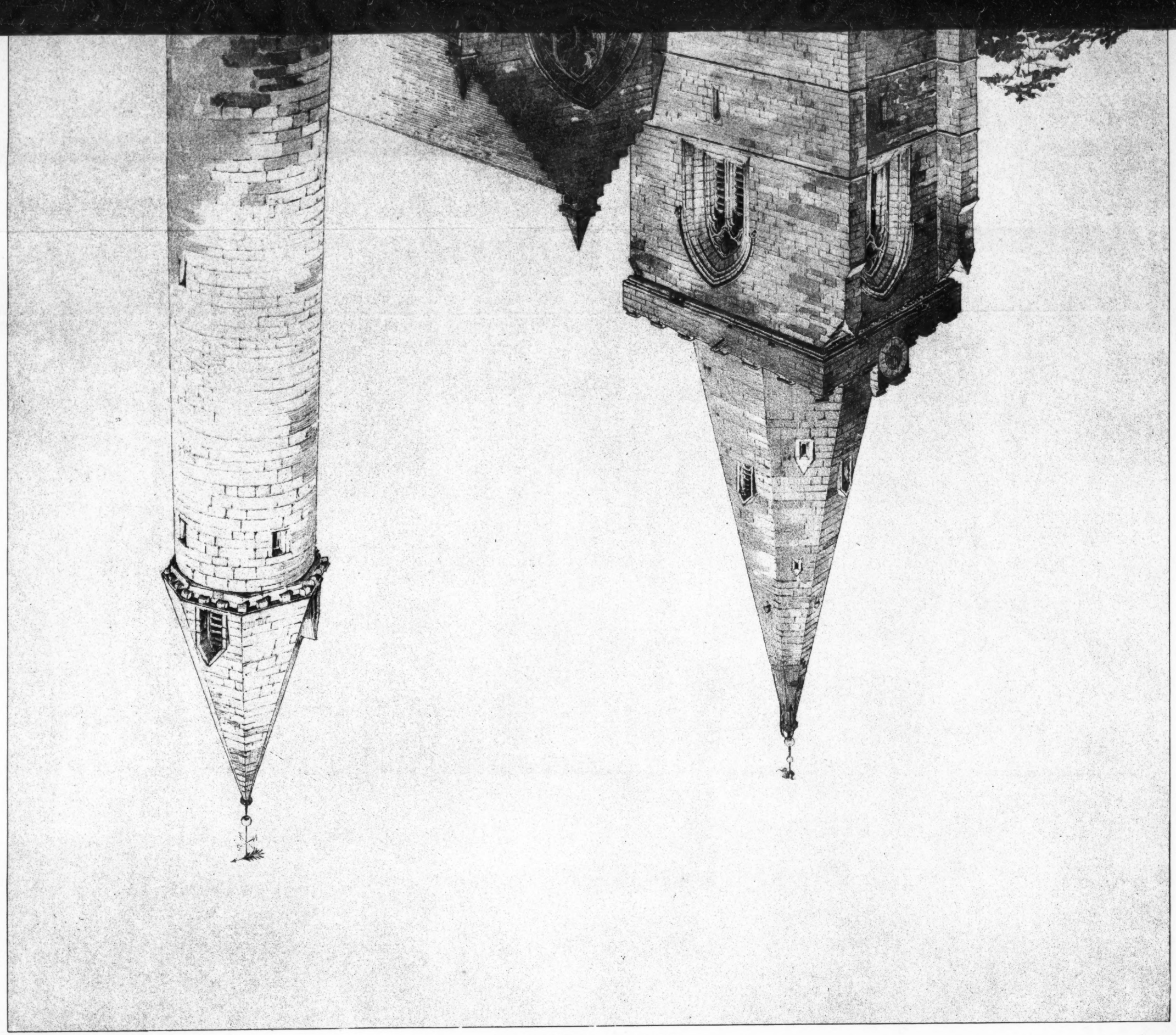

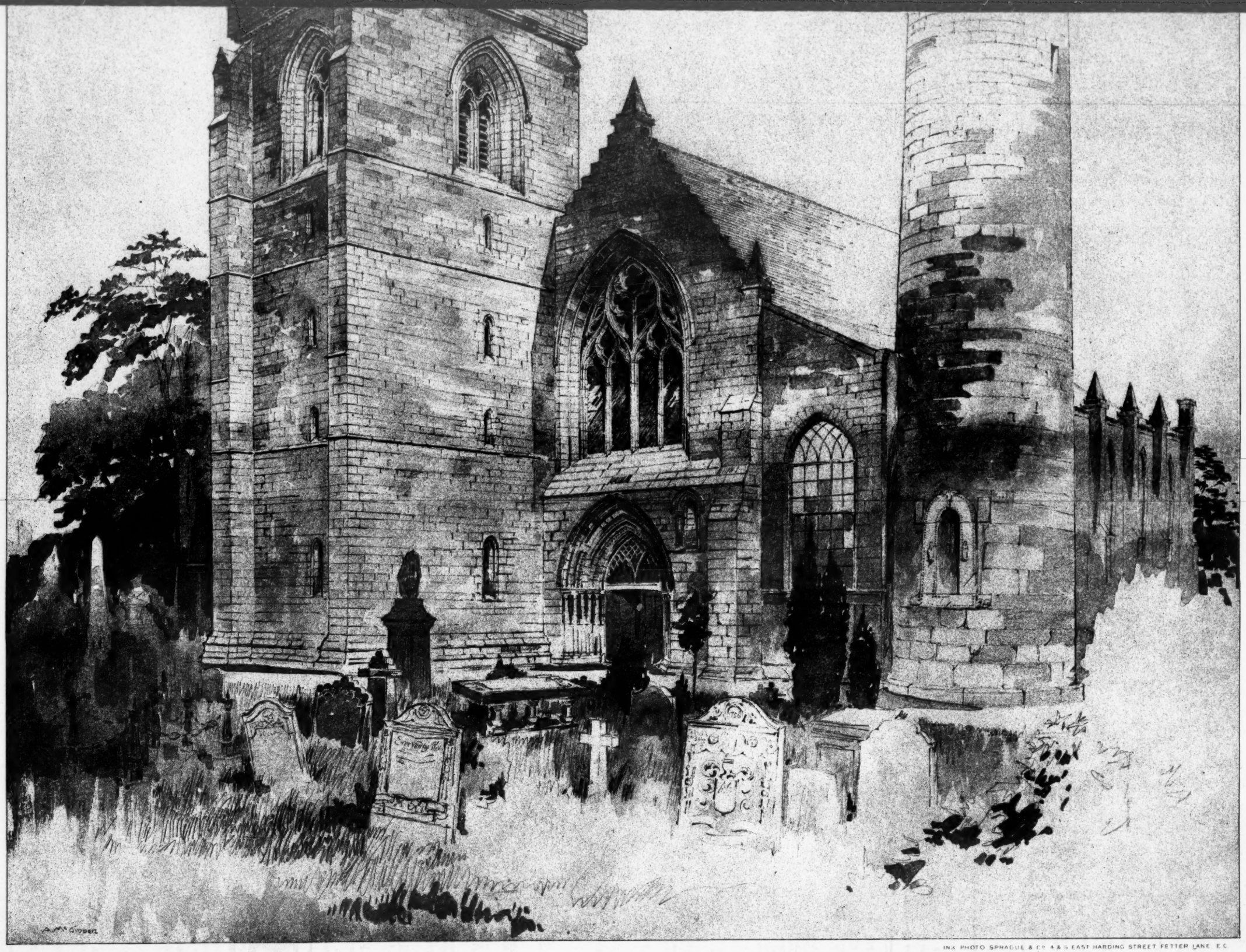

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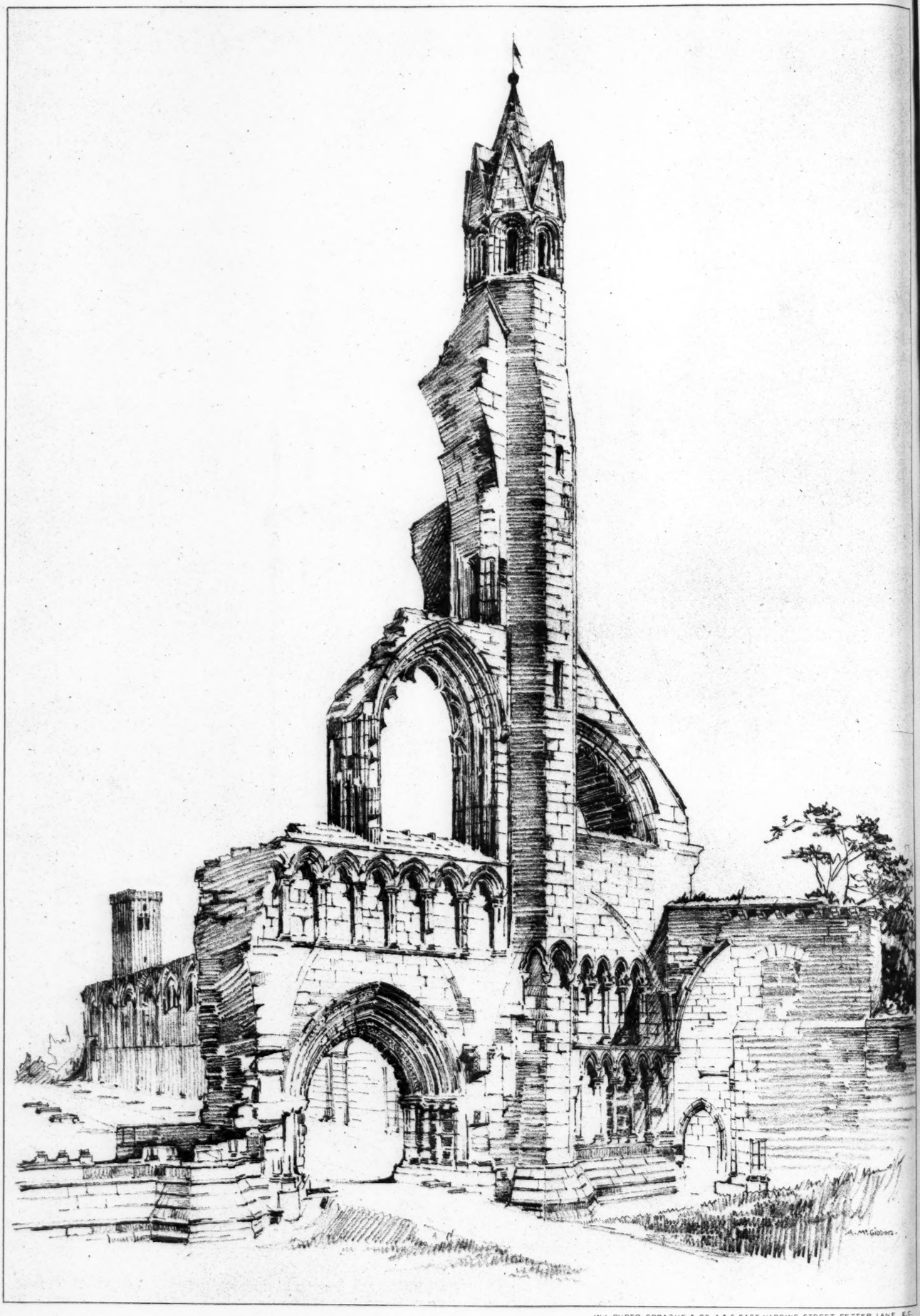
THE ANCIENT CATHEDRALS OF SCOTLAND.—Drawn by Mr. Alexander McGibbon.

No. 9. BRECHIN.



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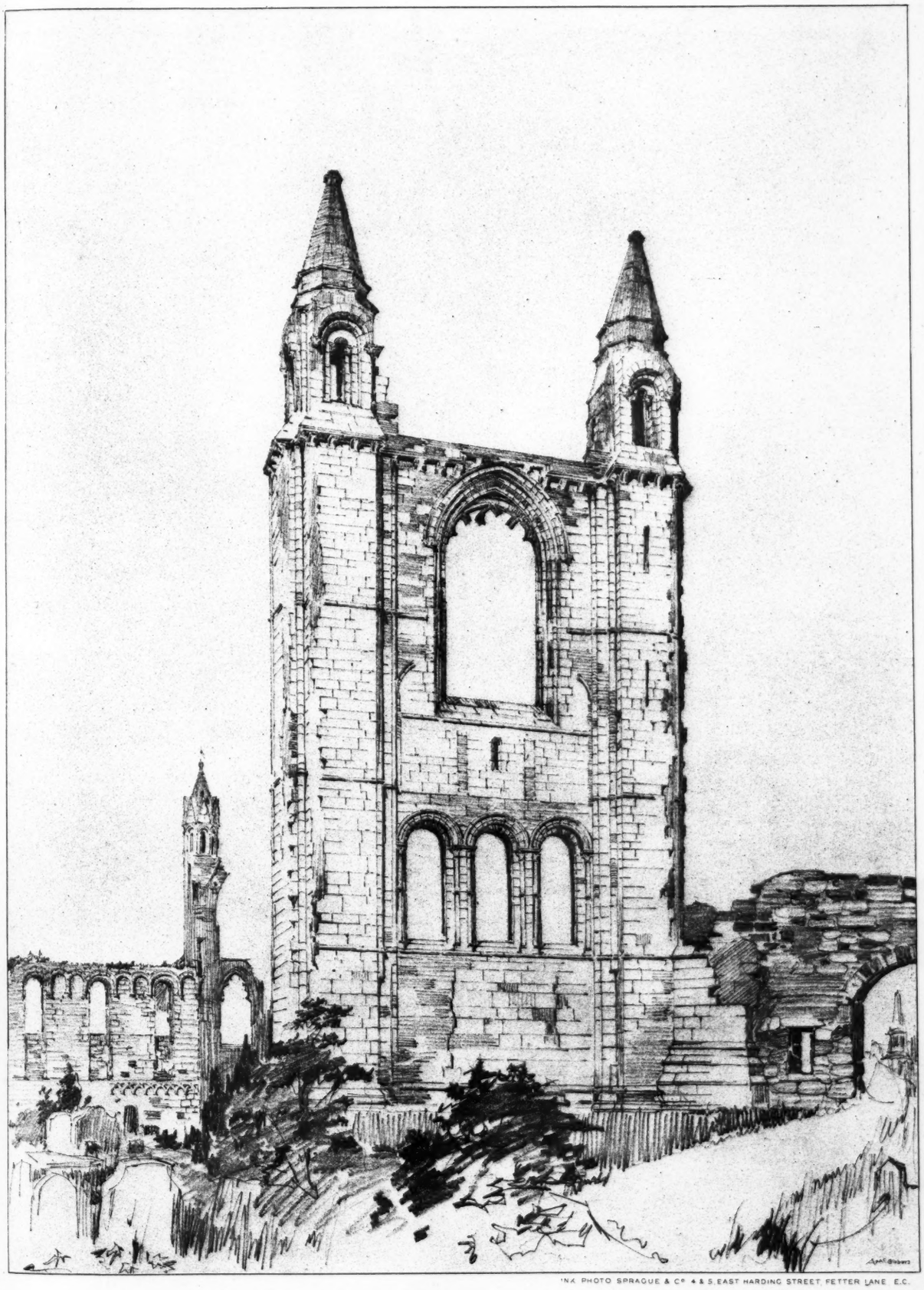
No. 8. REMAINS OF ST. ANDREW'S: VIEW FROM NORTH-WEST.



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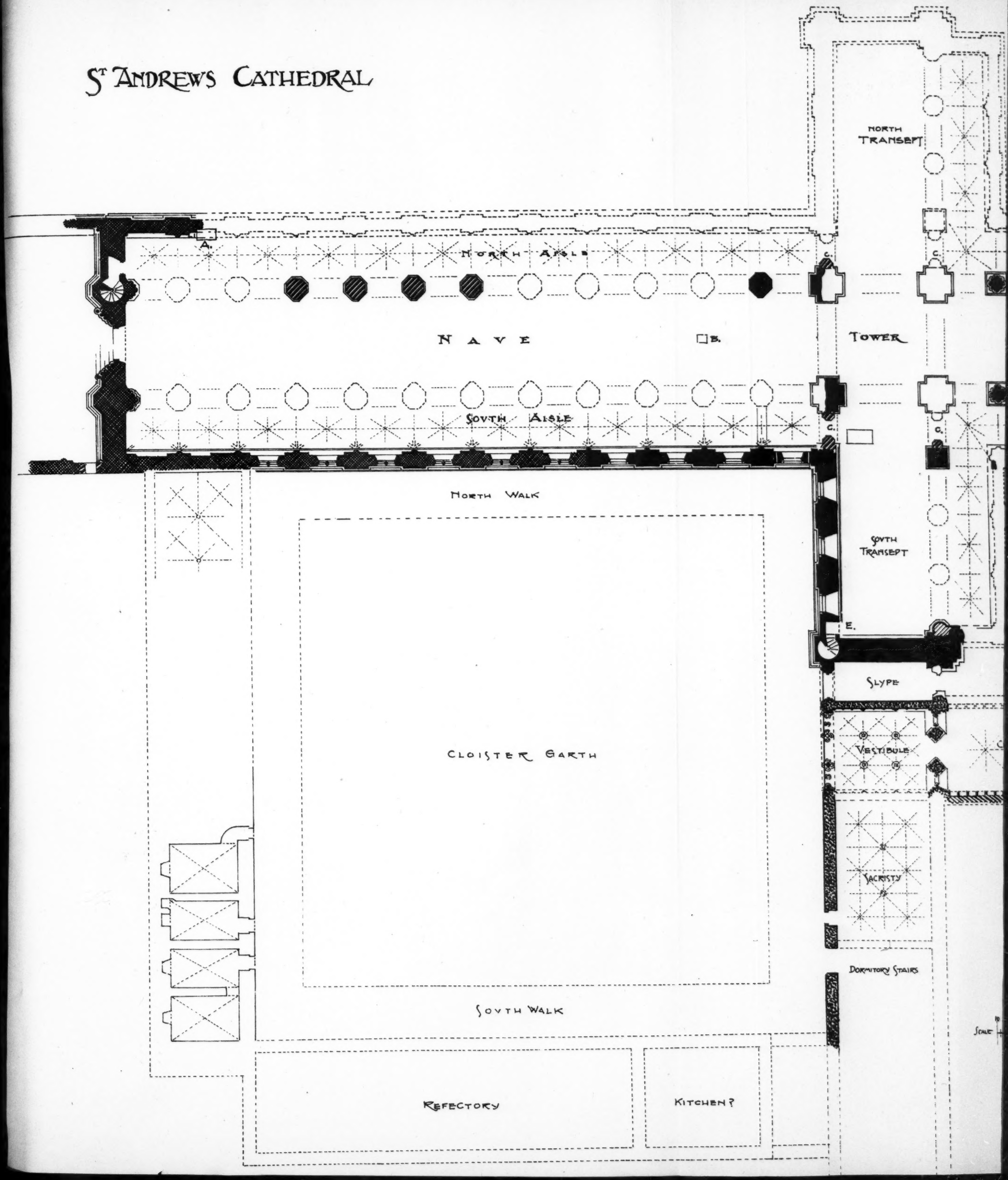
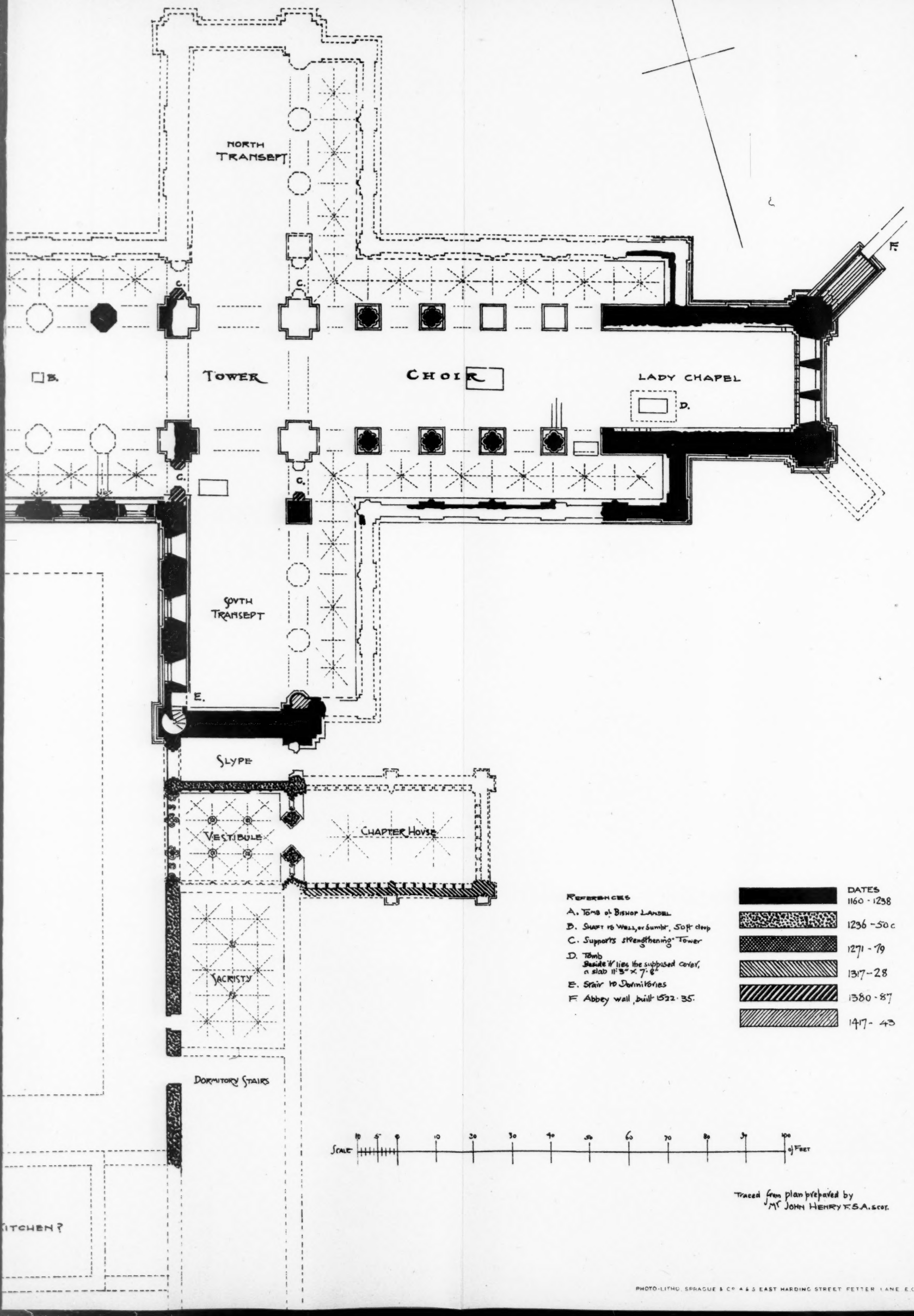
No. 8. REMAINS OF ST. ANDREW'S: VIEW FROM SOUTH-EAST.

St Andrew's Cathedral





REFERENCES

A. Tomb of Bishop Ladell
B. Shaft to Well, or Sumbr, 50ft deep
C. Supports strengthening Tower
D. Tomb
Beside it lies the supposed cover, a slab 11'3" x 7'6"
E. Stair to Dormitories
F. Abbey wall, built 1522-35.

DATES
1160 - 1238
1236 - 50 c
1271 - 79
1317 - 28
1380 - 87
1417 - 43

SCALE 10 5 0 10 20 30 40 50 60 70 80 90 100 of FEET

Traced from plan prepared by Mr JOHN HENRY F.S.A. Scot.

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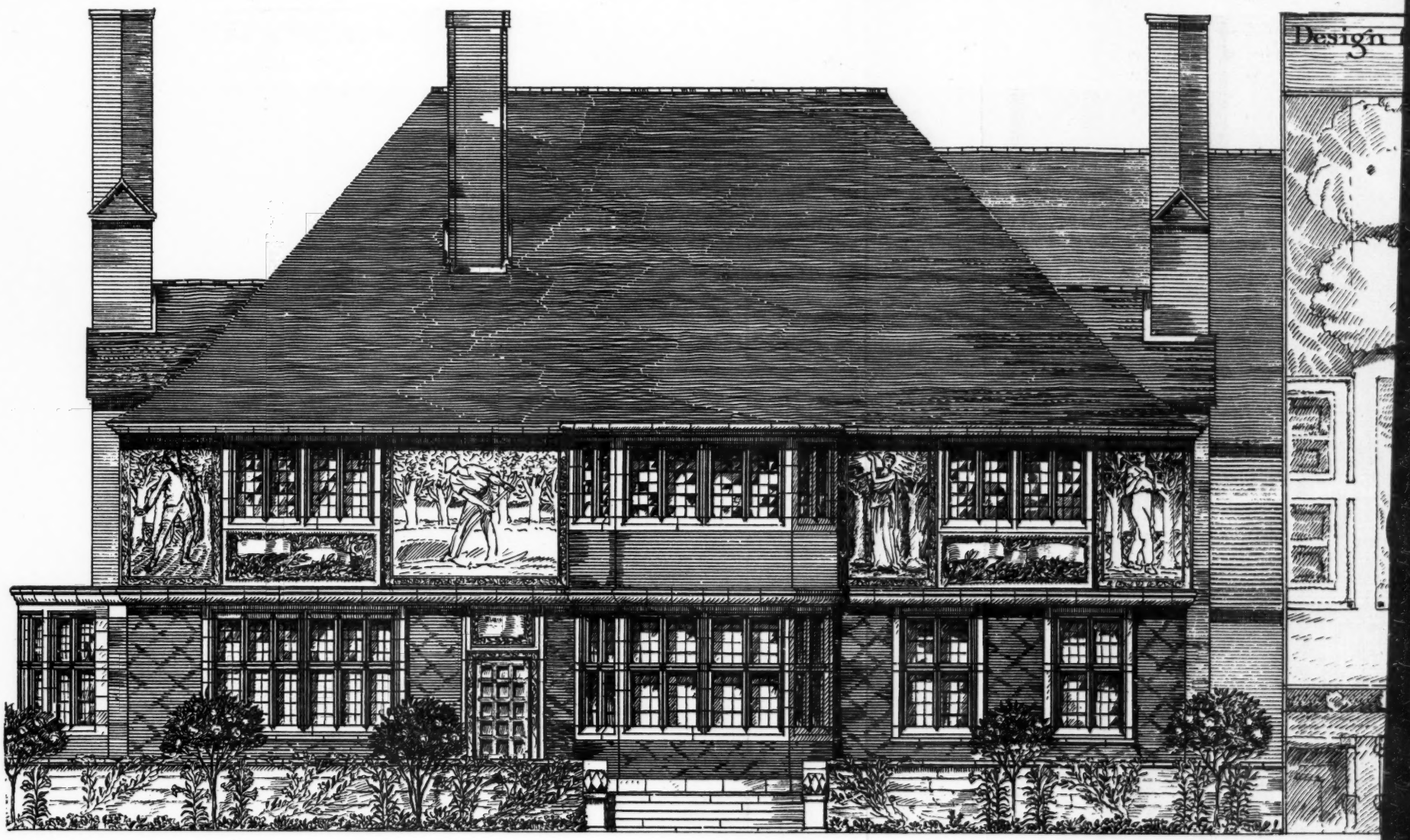

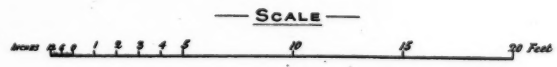

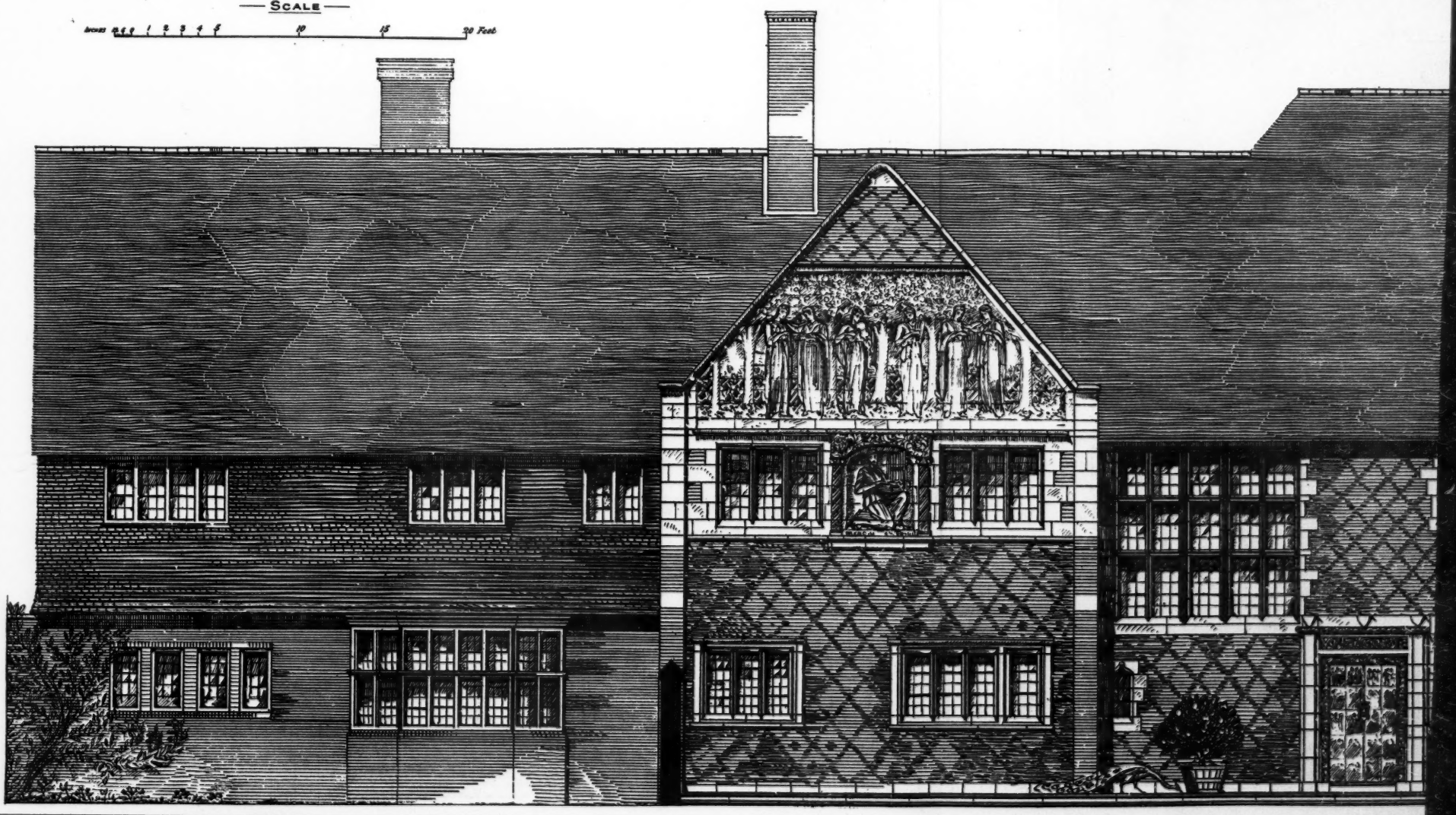

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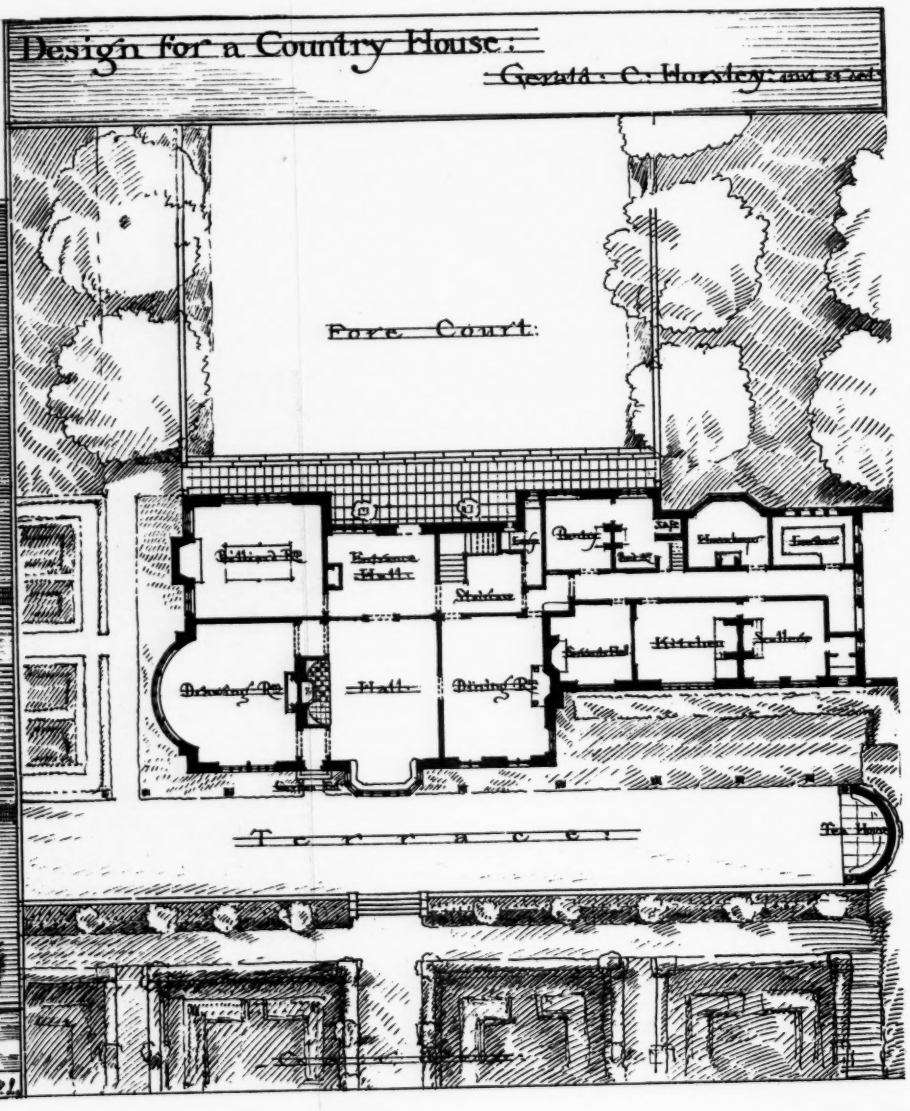
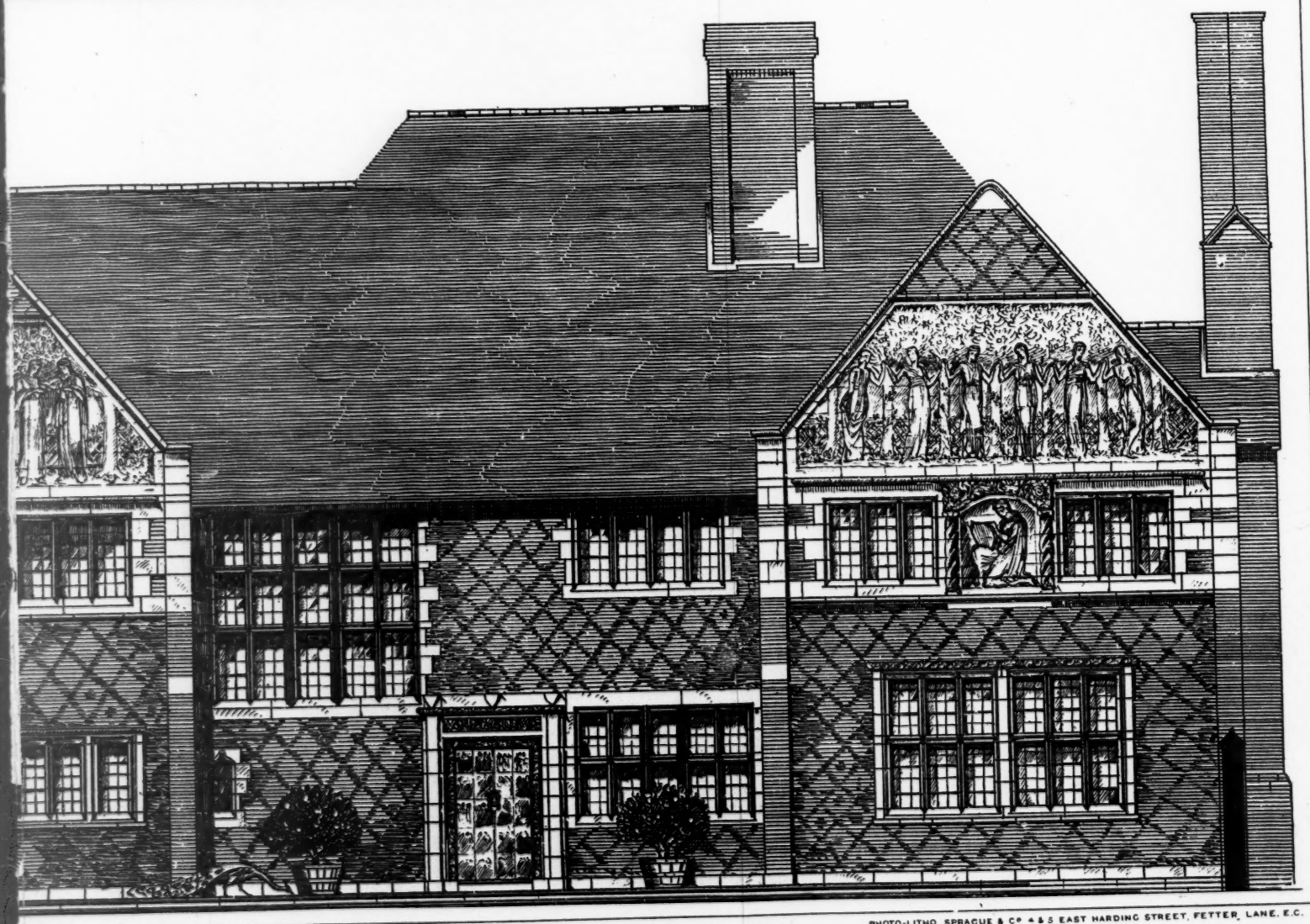
Gerald C. Horsley. ARCHITECT





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